Vol. XIX. Part 7.

NATIONAL MUSEUM OF VICTORIA

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The Journal of the Department of Agriculture of Victoria, Australia.

July, 1921.

PRINCIPAL CONTENTS

Inter-District Farm Competition

Improvement of Crops by Selection

Summer Forage Crops

Summary of Herd Testing Results 1919-20

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THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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W. & W.—653.

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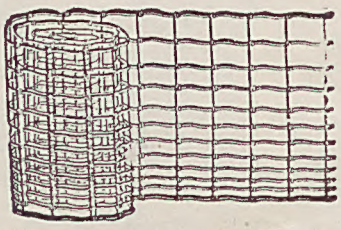

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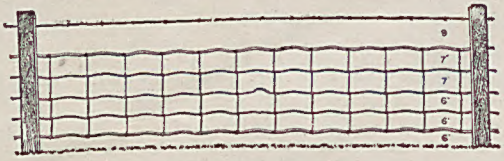

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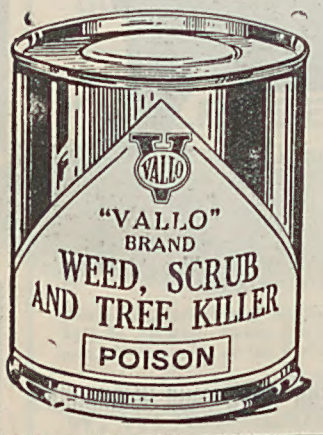

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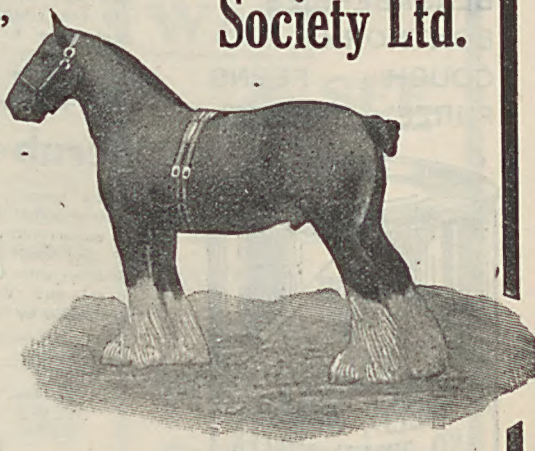

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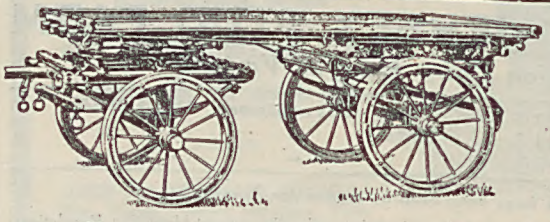

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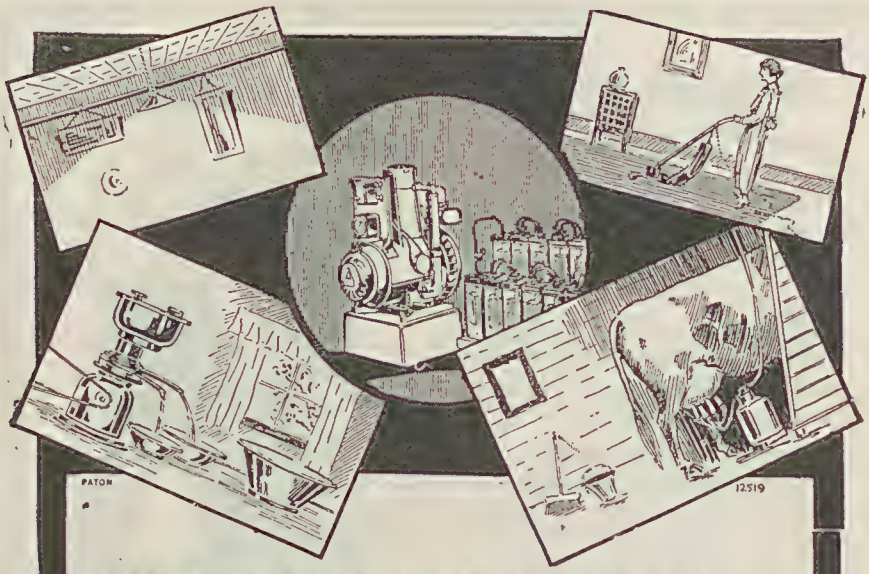

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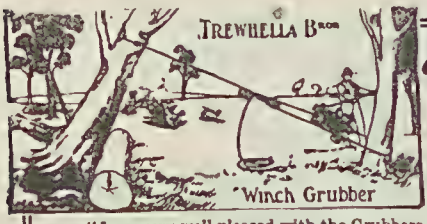

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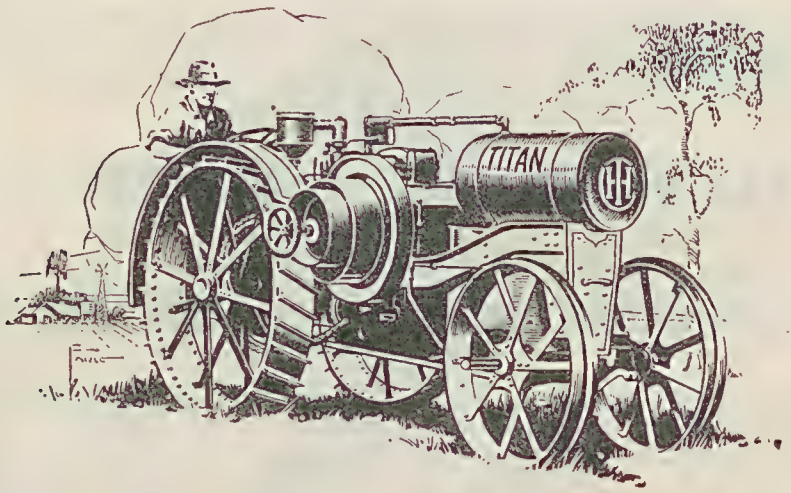

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OF THE

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INTER-DISTRICT FARM COMPETITION.

ROYAL AGRICULTURAL SOCIETY'S SECOND COMPETITION, 1920-21.—PRIZES £100.

Report of the Judge, H. A. Mullett, B.Ag. Sc., Chief Field Officer, Department of Agriculture.

Steward—J. Keane, B.Ag. Sc.

In presenting my report, as judge of the Second Farm Competition, for prizes donated by the Royal Agricultural Society, it is fitting that attention should be drawn to the greatly increased interest shown by the members of the local Agricultural Societies in this Competition, and in the scheme of District Competitions which it is intended to foster.

There is abundant evidence that the whole movement is productive of good. It is not only proving a powerful agent for the discovery and dissemination of the best local farm practice, but it is inducing many farmers to improve their homes and their general conditions of living as well.

The Royal Society's Competition has also provided facilities for the collection of valuable data relating to the business side of farming. By this means, up to the present, complete records of the business activities of twenty-one farms have been ascertained, and these will form the basis of research into farm management problems under local conditions.

JUDGING THE LOCAL COMPETITIONS, 1920.

The rules of the Agricultural Society's Competition provide that only first and second prize winners in District Competitions in the Wimmera and Mallee shall be eligible. This provision has induced a substantial increase in the number of local competitions in those districts. Thus, in 1918, four societies held competitions, in 1919 there were six, last year there were eleven.

They comprised the following:—

TABLE SHOWING DETAILS OF LOCAL COMPETITIONS CONDUCTED BY AGRICULTURAL SOCIETIES, 1920.

District.	No. of Entries.	No. of Farms Inspected.	Type of Competition.
WIMMERA—			
Nhill ..	64	24	Farm, and Crop and Fallow Competition
Rupanyup ..	61	29	Crop and Fallow Competition
Warracknabeal	26	15	" " "
Minyip ..	29	14	" " "
Dimboola ..	19	12	" " "
Goroke ..	18	12	" " "
Horsham ..	13	10	" " "
Kaniva ..	13	6	" " "
MALLEE—			
Beulah ..	27	18	
Sea Lake ..	12	11	" " "
Ouyen ..	5	5	" " "
			Farm Competition
Total ..	287	156	

In all, there were 287 separate entries in the different districts. They were lodged by 156 farms. The judging, which took place during November and December, occupied me fully for about five weeks, and Field Officers I. M. Tulloh and G. Mather each about two weeks. Apart from railway journeys, 2,000 miles of road travelling was involved. The whole of the cost of road transport was borne by the farmers themselves. Some 23,000 acres of wheat and 10,000 acres of fallow were subjected to a careful investigation and classification. The exhibitors were closely questioned as to their farming methods, and complete records were taken. This information was embodied in reports furnished to each Society for publication in the press. In many cases the Societies have reprinted it in pamphlet form for distribution among district farmers.

A list of eligible competitors was then presented to the Royal Society. Each local competition was regarded as a means of publicly determining the best crops and fallows in the district for the season. Comparisons were made between good and bad crops, and efforts were made to account for the differences. In a number of districts, the same fields under crop and under fallow have been under observation by the one judge each year for a number of years. In their case the evidence is very complete.

In several instances, the continued success in the competitions of wheat crops raised by the employment of certain methods has pointed in a very definite way to profitable practices, and has led to their extension.

For instance, one of the fields of work in which some measure of success has already been obtained by this method, is the standardization of the best methods of cultivating black land in the Wimmera.

Again, on these soils, the value of summer fallowing, and in a dry year, the importance of shallow cultivation of the fallows, has been repeatedly demonstrated.

Numerous instances of increased yields following the use of heavier dressings of superphosphates, increased rate of seeding, and, on the

The Most Comfortable Home in the Competition—that of Mr. F. W. Sallman, Dimboola.

black land, late sowing, have been brought to light. The occurrence of "Take-all" (*Ophiobolus graminis*) has been studied, and attempts have been made to correlate it with the rotation system employed and the depth of ploughing adopted.

A special effort has been made to search for some plant likely to provide better food on the idle part of the farm in the wheat belt than native pasture or wild oats, and "Wimmera Rye Grass" (*Lolium subulatum*) was the result.

JUDGING THE ROYAL COMPETITION, 1921.

This took place during portion of April and May. The farms of eleven competitors, who had qualified for entry by winning a first or second prize in a local competition, were inspected. Points were allotted according to the scale set out in the Society's Show Schedule, details of which are shown in the table of awards.

The following is a summary:—

Crops and stock	100
Machinery, buildings, and plant	100
The farm as a business and a home ..	100
	300

Portion of the marks for the crop and fallow was awarded at the local competition at harvest time and carried forward. An average of one and a-half days was spent at each farm, and a detailed inspection made of each department. Special attention was paid to the business investigations, and competitors were requested to furnish, in confidence, copies of their income tax schedules for the past three years, together with evidence of having paid the tax thereon. From these the revenue and expenditure from each farm activity were ascertained.

In addition, a valuation of the land and improvements, plant and implements, live stock and fodder reserves was made, in order to arrive at the capital outlay, and hence the "labour income" of the farm. The labour incomes were then compared according to a sliding scale based on the capital investment.

TABLE ILLUSTRATING THE TYPES OF FARMING FOLLOWED BY THE VARIOUS COMPETITORS.

Name.	Area.	District.	Main Source of Revenue.	Average Area in—			Average No. of Sheep carried.	Per cent. of Total Area under Cultivation.
				Wheat.	Oats.	Fallow.		
	acres			ac.	ac.	ac.		
W. R. Hemphill	513	Rupanyup, Wimmera	Wheat and sheep	160	50	160	150	72%
G. Nettlebeck ..	544	Dimboola, Wimmera	Wheat ..	180	40	200	50	77%
R. C. F. Gniel ..	639	Walpeup, Mallee	" ..	180	20	200	70	63%
R. Jackson ..	690	Rupanyup, Wimmera	" ..	265	40	275	50	84%
E. Hoffman ..	760	Nhill, Wimmera	Wheat and sheep	160	40	200	200	53%
W. E. Dahlenburg	840	Nhill, Wimmera	Wheat, sheep and pigs	240	200	250	300	82%
M. Brennan ..	1,280	Sea Lake, Mallee	Wheat and sheep	400	100	400	500	70%
J. Sweetman ..	1,480	Rupanyup, Wimmera	Wheat and sheep	420	115	400	450	64%
R. McCollim ..	2,460	Warracknabeal, Wimmera	Wheat and sheep	300	100	300	900	28%
F. W. Sallman ..	2,448	Dimboola, Wimmera	Wheat, sheep and stud horses	600	300 to 400	700	1000	67%
F. Irving ..	3,000	Sea Lake, Mallee	Sheep and wheat	500 to 600	100	250	1500	30%

The Home of the First Prize Winner—Mr. W. E. Dahlenburg.

The areas of the farms varied from 513 to 3,000 acres. The majority, however, were wheat farms, ranging from 640 to 1,500 acres. Three were Mallee farms.

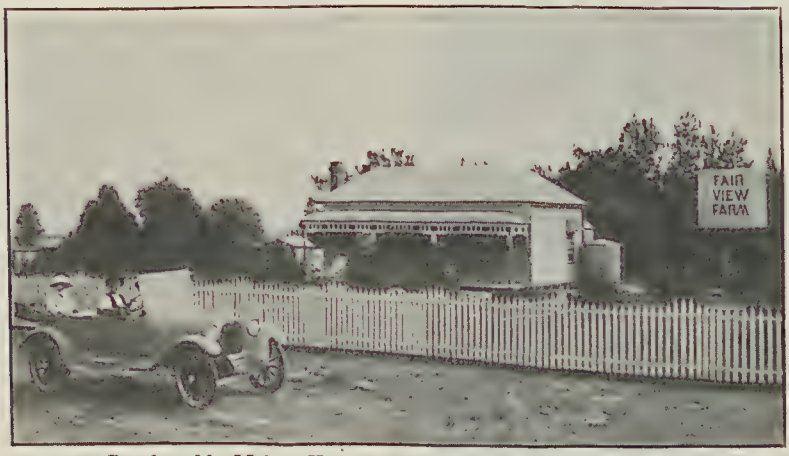
The smaller the farm, the greater the tendency to crop heavily to wheat; conversely, the larger the farm, the greater relative attention paid to sheep. Three of the farms depended largely on wheat for their revenue; five partly on wheat and partly on sheep; one on wheat and sheep and other live stock, another on wheat and sheep and stud stock, and one largely on sheep. The results of the business survey are all the more instructive, by reason of these divergencies of method, because of the comparisons they afford.

It was realized at the outset that the inclusion of farms of such widely differing soils as the Wimmera and Mallee would increase the difficulties of making fair comparisons; so, too, the varying areas of the farms and the objectives of the farmers. The difficulties have not proved insuperable, but now that interest has been sufficiently stimulated in both the Mallee and Wimmera to insure reasonable competition, it has been decided to limit, in future, the Royal Society's Farm Competition in any one year to farms on the one type of soil. Next year the Competition will be confined exclusively to Mallee land. Possibly, in the future, if there are sufficient centres, Competitions may be limited to farms of one class.

RESULTS.

The Winning Farm.

The winner of the Competition was, again, Mr. W. E. Dahlenburg, of "Ellerslie," Salisbury; 236 marks were gained out of a possible 300. This farm, which is 840 acres in area, has been specially laid out by Mr. Dahlenburg, in the light of knowledge disseminated during the past twenty years by the Farm Competitions conducted by the Nhill



Comfortable Mallee Home of Mr. R. C. F. Gniel, Walpeup.
(Mr. Gniel's farm has been carved out of the virgin bush after nine years' settlement.)

Compactly Arranged Home and Farm Buildings of Mr. E. Hoffman, Nhill.

Agricultural Society. The homestead, the attempts to improve the environment, subdivision, arrangement of buildings, water supply, &c., all showed evidence of most careful planning.

There was much keener competition this year, and Mr. Dahlenburg was closely pressed by Mr. F. W. Sallman. The consistently high standard of each department of the winning farm, however, gained the day.

Economical Type of Farm Buildings (Mr. W. R. Hemphill's, Rupanyup).

On Mr. Dahlenburg's farm, in addition to the cultivation of an average of 240 acres of wheat, 200 acres (10 on fallow) are sown to oats for hay and forage. This is a rotation system which, in addition to assisting in maintaining the fertility of the land, provides autumn and winter feed for live stock, on what would otherwise be bare pastures.

Portion of the farm, less valuable for cultivation than the rest, is being laid down in Wimmera rye grass as a permanent pasture.

Special attention is paid to live stock. The horses and cattle (Red Polled) are of a good class. Pig-raising is conducted on a substantial scale.

The "labour income" on the capital employed, though satisfactory, was not as high as might have been expected, but this is due to the exceptionally dry season experienced at Salisbury in 1919. Mr. Dahlenburg established such a strong lead in other departments that he was able to win despite this handicap.

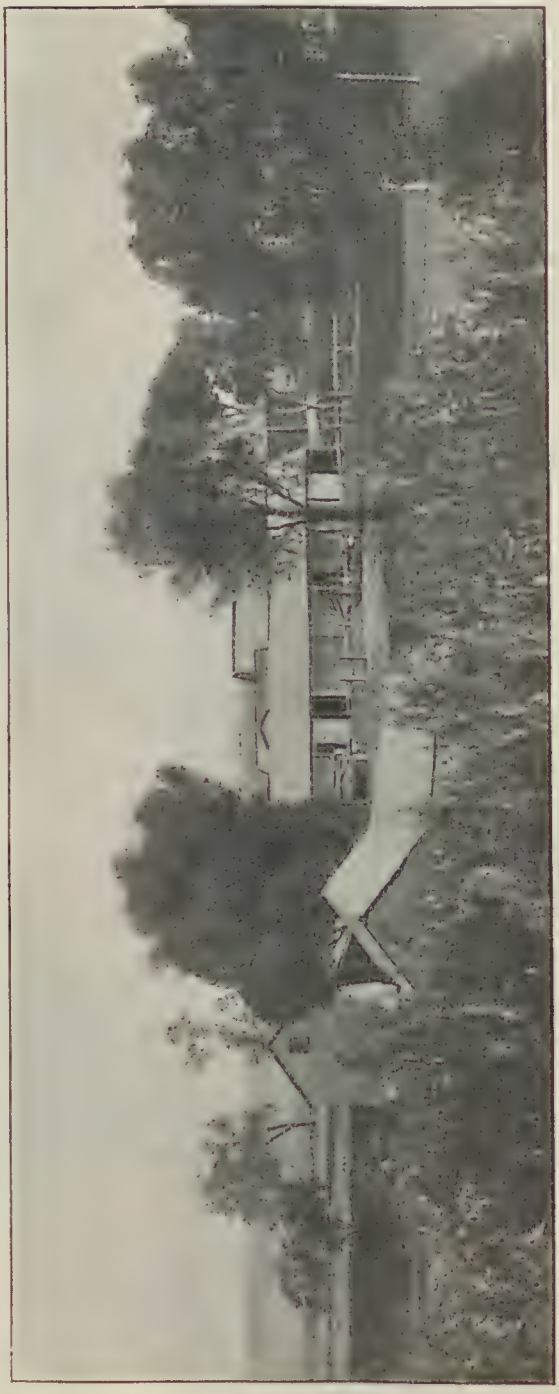
Further details of the main activities of this and the other farms will be referred to later under appropriate headings.

Mr. F. W. Sallman's farm, "Kornheim," Dimboola, was second, with 233 marks. This farm is a large one of 2,448 acres. There is a most attractive homestead, snugly located among well-grown sugar gums, and surrounded by a well-kept garden.

Special attention has been paid by Mr. Sallman to the development of a high-class Clydesdale stud, which has

achieved notable success in the show ring. The bulk of the stud was, however, disposed at a dispersal sale, just prior to the judging, and, therefore, unfortunately, could not be marked. The land is as good as any in the Wimmera, and has been worked on a rotation system resembling that of Mr. Dahlenburg. The weak spot was a somewhat low supply of hay on hand, due probably to the necessity for getting up the stud for the sale.

Mr. R. C. F. Gniel, a competitor who was fourth last year, was next, with 231 marks. This farm is one that has been carved out of the virgin bush, as the result of but nine years' settlement. Mr. Gniel has brought it to a remarkable pitch of efficiency. There is an attractively situated home, and the farm buildings, though not so substantial as some exhibited, are, nevertheless, laid out as attractively and to as great advantage as



Farm Buildings of Mr. J. Sweetman, Rupanyup.

those of any other competitor. Considerable improvements have been effected since last year. Windmill and tankstand, for house and garden water supply, had been added, sheep have been purchased, and 5½ miles of substantial sheep-proof fencing erected. Water supply, fodder reserves, and cropping methods were excellent.

The high percentage return on the small capital outlay on this farm is evidence of the suitability of the new Mallee for sound farmers with limited capital.

Mr. E. G. Hoffman's farm, "Koonawarra," Nhill, was next. It has a neat homestead, excellent garden, and well laid-out farm buildings. The business figures were exceptionally good.

Mr. W. R. Hemphill's farm, Burrero, Rupanyup, is portion of 1,026 acres of black soil, worked by two brothers with the one plant. The business figures were exceptionally good.

Mr. J. T. Sweetman's farm, Rupanyup, is notable for some substantially-built and well-designed improvements, in the shape of stables, barns, &c. The most interesting feature, was, perhaps, the mouse-proof hay shed, of 150 tons capacity. This is conveniently disposed in relation to the chaff store, and is provided with trolly on rails for the economical transference of hay to the chaffcutter. The farm yard is laid out in an effective and attractive manner, and is well supplied with shade trees. The homestead is a comfortable one.

Mr. G. Nettlebeck's farm of 544 acres, is situated on rising ground close to the Dimboola Railway station. The homestead, a most attractive one, has been constructed of sandstone, large deposits of which occur in the Wimmera. On this farm the water supply for the house, stables, &c., is ingeniously syphoned from a dam on the hill, dispensing with the aid of a windmill. The farm buildings are solidly constructed, railway sleepers being largely used. The farm is closely cropped to wheat—only a few sheep being kept. The business returns are good.

Mr. R. Jackson's farm is located at Burrero, Rupanyup. It is one that is closely cropped to wheat—few sheep being kept. This farm is notable for a remarkably heavy crop of wheat last year; 263 acres sown averaged 43 bushels per acre. A new homestead has recently been constructed.

Mr. M. Brennan's farm is a Mallee one of 1,280 acres. It is situated at Berriwillock, near Sea Lake. The fallow was excellent, and the rotation system good.

Mr. F. Irving's farm of 3,000 acres was once portion of Tyrell Downs sheep station. It is in process of being improved. From 500 to 600 acres are sown to wheat each year, and 1,500 sheep maintained. Among the interesting features of this farm are the neat bush workmanship shown in a new stable, and the excellent type of crossbred sheep maintained. This is the only farm in the Competition where a complete set of books was kept—and they were kept in a most competent manner by a woman!

As Mr. R. McCollim had held a clearing sale, the live stock and machinery could not be judged. Mr. McCollim, however, decided to submit the remainder for inspection and award.

TABLE SHOWING SCALE OF POINTS AND DETAILS OF MARKS AWARDED.

Name.	Best Method of Cropping, Rotation, and Methods of Cultivation.	Character, Condition, and Value of Farm Crop.	Fallow.	Horses.	Sheep.	Cattle.	Pigs.	Poultry.	Machinery and Equipment.	Character and Arrangement of Farm Buildings.	Water Storage.	Fences, Gates, &c.	Orchard and Vegetable Garden.	Trees for Shelter.	Fodder Reserves.	Insurance.	Home.	Total.	Business.	Grand Total.
Points	**25**	**25**	**10**	**15**	**10**	**5**	**5**	**5**	**15**	**10**	**25**	**10**	**5**	**5**	**25**	**5**	**25**	**225**	**75**	**300**
W. E. Dahlenburg ..	24	23	10	12	7	5	5	2	14	7	23	8	4	3	22	2	19	190	46	236
F. W. Sallman	22	23	8	14	6	4	2	2	14	5	20	6	3	5	15	4	25	178	55	233
R. C. F. Gniel	19	21	10	6	7	2	1	2	12	7	22	8	3	4	21	2	20	167	64	231
E. G. Hoffman	17	19	7	10	8	2	0	4	12	6	16	5	2	3	19	3	23	156	70	226
W. R. Hemphill	18	22	9	8	5	2	1	3	10	5	17	7	3	1	21	0	15	147	70	217
J. T. Sweetman	15	16	7	7	4	4	1	3	12	10	23	3	3	5	25	4	23	165	51	216
G. Nettlebeck	16	21	8	9	1	2	2	2	8	8	15	8	3	2	19	1	22	147	68	215
R. J. Jackson	16	25	7	8	2	3	2	3	11	4	13	5	0	1	20	1	15	136	60	196
M. Brennan	20	21	9	6	5	2	1	2	8	4	16	4	0	1	20	3	12	134	48	182
F. Irving	14	22	6	6	9	4	2	2	11	5	10	7	0	1	10	3	10	122	32	154
R. McCollim	14	19	8	..	..	..	..	..	..	5	16	7	2	2	17	..	14	..	42	..

CROPPING SYSTEMS ADOPTED.

Enough has been said already to show the wide variations that exist in the systems of farming practised by the various competitors. On the smaller farms the land, as a rule, is closely cropped without rest, and the number of live stock maintained is correspondingly low. From the revenue point of view, there appears to be an immediate gain from such a practice, but the fertility of the soil may be expected to slowly diminish. However, a study of the crops grown on the black soils of the Wimmera, which have been so treated, has not, so far, revealed any evidence of this, though, it was observed that "Take-all" and flag smut are gaining ground. Indeed, far from the yields declining, the history of most of the closely farmed paddocks shows them to be on the increase. During the past three years, the yields of wheat obtained by Mr. Nettlebeck, at Dimboola, using the two-course system—bare-fallow, wheat—are 21½ bushels, 26½ bushels, and 26½ bushels respectively.

Mr. Jackson is another who heavily crops the land. In any one year 84 per cent. of the farm is either under crop or fallow. Several of the paddocks have averaged three crops each in six years. No decline in yield is noticed; on the contrary, there appears to be an increase. It was on paddocks farmed on this system that Mr. Jackson obtained his splendid average last year.

Other instances can be quoted where similar results have been noted, a classic instance being the 300-acre paddock of Mr. D. N. McLennan, of Marnoo, which had seven wheat crops in fourteen years, and which, in 1919, won the farm competition at Rupanyup, with the splendid average of about 36 bushels to the acre.

While the decline in fertility, if any, may be slow, there is no doubt that such a system of farming exposes the grower to considerable risk of attacks from diseases such as "Take-all." Sooner or later "Take-all" infects the field, and the ungerminated spores attached to straw litter maintain the disease during the fallowing period. Each successive wheat crop is thus infected in turn, the spores becoming more abundant meanwhile. Ultimately, an exceptionally favorable opportunity for the disease presents itself; then the loss in wheat may reach five or six bags to the acre. A notable example of such a case was experienced by Mr. A. Lutze, of Coromby, who was a competitor last year. The cropping sequence adopted by him is fallow, wheat, fallow, wheat, fallow, wheat, oats, pasture, pasture, pasture. This system proved satisfactory for a number of years until last year. In one of the paddocks the usual oat crop was omitted, the wheat stubble was not burnt, and the usual spring working somewhat neglected. The result was a severe attack of "Take-all" in that paddock; a fence separating two fields of Federation wheat differing in yield by five bags to the acre.

It may appear strange that land spelled to grass for several years is not freed of "Take-all." The common experience, however, is that a prolonged spell in grass renders the next wheat crop liable to the disease. Instances have been noted where, when a strip of virgin land has been added to a cultivation paddock, the first crop has been badly infected while the older cropped land alongside was practically free. Such a case was seen at Mr. Schwartz's place at Dimboola last year.

There appear to be two reasons, first, the barley grass, which largely comprises the pasture, and which is known to be a host plant for "Take-all," allows the disease to multiply; and, secondly, the land in grass for several years is very difficult to consolidate. It has been repeatedly observed that lack of consolidation, whether after grass or stubble, is conducive to "Take-all."

If the facts are accepted, the remedy seems to be, either to reduce the spell in grass to one year, which does not appear detrimental, or to largely substitute forage oats for the year in grass. This is a practice which has been adopted by two of the competitors—Messrs. W. E. Dahlenburg and F. W. Sallman.

The majority of Wimmera farmers do not sow more than 70 or 80 acres to oats annually, but the two farmers mentioned sow 200 and 350 acres, respectively. This year Mr. Sallman has 420 acres, and the

Douglas Chief (imp., N.Z.), Sire, General Douglas (imp.). Head of Clydesdale Stud of Mr. F. W. Sallman, Dimboola.

greater portion of this is expressly for forage purposes, though in a good year, part, after feeding off, may be closed up and stripped. At the time of judging Mr. Sallman had a field of 145 acres of Algerian oats which was a splendid sight. It had been sown in mid-March, at the rate of 1½ bushels per acre, without manure, and furnished useful grazing for ewes and lambs while surrounding native pastures were scanty.

Mr. Dahlenburg finds that he can maintain twice as many sheep per acre under his system of providing oat forage.

An interesting feature of the modern trend of thought with regard to oat-growing in the Wimmera is the gradual recognition by the more up-to-date farmers of the wisdom of sowing portion of the oats on fallowed land. This policy always insures a supply of good quality hay, even in a dry year. Despite the satisfactory yields of oaten hay from

crops sown on stubbles in a good year, it has been demonstrated at the Research Farm, Werribee, that the increased yield of hay obtained by fallowing more than pays for the extra trouble involved.

The result of the business analysis conclusively demonstrates that on Wimmera land the larger the farm the greater the difficulty in maintaining the rate of interest earned by the capital. This is because of the trouble in efficiently managing the labour on large farms. Rather than cultivate his farm at its maximum capacity, the large farmer carried proportionately more sheep. But on land valued at from £12 to £15 per acre, carrying only two-thirds of a sheep to the acre, sheep

A Retired Champion, Daphney. Winner of Numerous Prizes
(F. W. Sallman, Dimboola.)

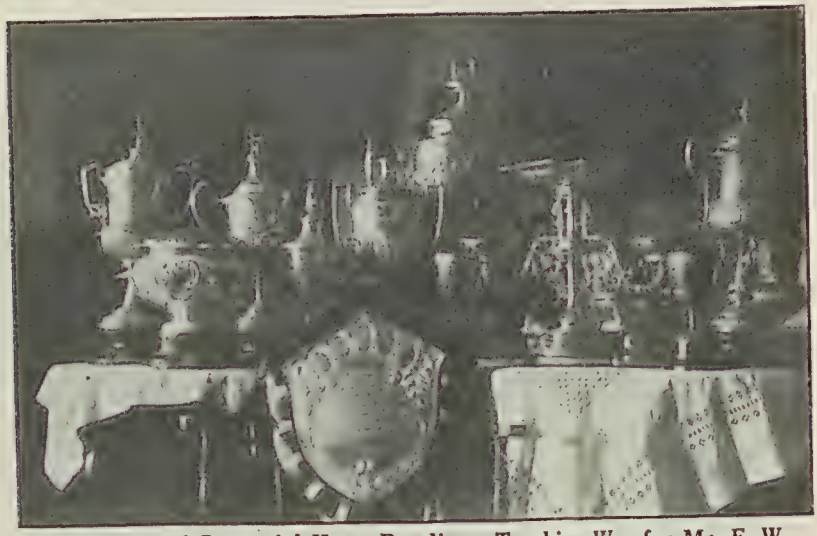
do not pay as well as wheat. The great problem to be faced by the man on the large farm is either how to increase the efficiency of labour, and hence the return from the cultivation, or else how to increase the returns obtained from the live-stock. This latter can be done in two ways, by increasing the quality of the live-stock, especially the breeding of studs, as Mr. Sallman has done, or by increasing the carrying capacity of the part of the farm in grass. This may be accomplished in several ways. The sowing of stubble oats as forage; the stimulation of the pasture by manuring the wheat crop more liberally, and lastly by the sowing down of pastures such as Wimmera Rye Grass.

All of these remedies have been adopted either by Mr. Sallman or Mr. Dahlenburg; hence the high proportion of marks earned by them under this head.

Mr. Hoffman up to the present has maintained the system, fallow, wheat, pasture. Forty acres of oats are grown each year on fallow. The system provides hay, but does not permit of a change into oats often enough. Mr. Hoffman intends to sow more oats this year, and has made a start with 60 acres of stubble oats expressly for forage. This was being sown with the combined drill at the time of judging. The machine was doing good work.

A couple of the competitors still sowed a small proportion of their wheat crops on stubbles.

The average proportion annually cultivated on the farms was 60 per cent. The lowest percentage was 30 per cent.—that of F. Irving's Mallee farm.



Mementoes of Successful Horse Breeding. Trophies Won for Mr. F. W. Sallman by his Stud Horses.

CROPS AND FALLOWS.

The fallows, and the methods employed in growing the farm crops, have been fully treated in the reports of the district competitions furnished to the local Agricultural Societies, and already published in the *Journal of Agriculture.*

The most prolific crops submitted were those of R. J. Jackson, 263 acres, 43 bushels per acre; W. E. Dahlenburg, 130 acres, 38 bushels per acre; and F. W. Sallman, 140 acres, 36 bushels per acre. The best fallows were those of W. E. Dahlenburg, R. F. C. Gniel, W. R. Hemphill, and M. Brennan.

LIVE STOCK.

Horses.

There are two aspects of the position occupied by the draught horses on the wheat farm—their efficiency as work stock, and their effectiveness as breeders. On some farms work is the sole consideration—nothing but geldings are kept. On most, however, two or three mares are regularly bred from. The young stock serves to replace the wastage in the workers, and forms as well a direct source of revenue.

In some cases, as at Mr. Sallman's, the breeding has been developed into a highly specialized department on which considerable time and money have been expended. Wheat-growers owe a great deal to the initiative and skill of breeders such as these. On them they depend for the production of draught stock of superior pace and stamina. Though the bulk of Mr. Sallman's Clydesdale stud had been disposed of, there still remained "Douglas Chief," an imported New Zealand horse of excellent quality, the well-known Clydesdale mare "Daphney," and several fine youngsters. Messrs. Dahlenburg and Sweetman were the only other competitors who paid special attention to breeding.

In judging the work-stock, attention was paid to age, regularity of type, condition, and capacity for work. Where low condition and remediable defects, such as sore shoulders, were noted, marks were heavily deducted.

The draught horse, under the conditions that prevail in the Australian wheat belt, is generally credited with an unusually high capacity for work. In view of that, steps were taken to determine the annual performance, in terms of acres cropped, of the teams on each of the farms entered in the competition.

The following are the results:—

District.	Name.	No. of Acres Cropped.	No. of Working Horses.	No. of Acres Cropped per Annum per Horse.
Wimmera ..	F. W. Sallman	950	25	38
,, ..	J. Sweetman	540	16	34
,, ..	W. E. Dahlenburg	440	12	37
,, ..	Hemphill Bros.	420	14	30
,, ..	R. Jackson	305	13	23
,, ..	E. Hoffman	200	11	18
,, ..	G. Nettlebeck	220	14	16
Mallee ..	F. Irving	650	16	41
,, ..	M. Brennan	500	12	42
,, ..	R. C. F. Gniel	200	10	20
		4,425	143	Average 30·9

From these figures it is obvious that the larger the area cultivated, the greater the acreage each horse is expected to cover. Provided that in each case the work was equally well done, the highest figure possible is the one that should be aimed at. But it is common knowledge that, unfortunately, the extra acreage is frequently gained at the expense of the requisite thoroughness with which each acre should be cultivated. Perhaps that, in part, is the explanation of the relatively lower rate of interest on the invested capital earned by the larger farms as compared with the smaller ones.

As a rule, on both types of wheat farm implements of the maximum size are used, the eight-horse team being a common standard unit.

It is of interest to note that for farms with equal area under crop, the average acreage cropped per horse is much higher in the Mallee than in the Wimmera, as might have been expected.

The best team of workers was exhibited by Mr. Dahlenburg.

Sheep.

In this competition all the competitors but two possessed a substantial number of sheep. It is of interest to note that the profits for the period 1917-18 to 1919-20, inclusive, from these two farms compare quite favorably with similar sized farms where the returns from sheep form a considerable part of the revenue. It may be that the profits from the farms quoted would have been improved had sheep been kept —that, of course, is a possibility. In any case it will need the consideration of a much larger number of instances before reliable figures are obtained. But the results of these investigations, as well as those of last year, show that the statement that wheat cannot be profitably raised without the aid of sheep is too sweeping. It is popularly supposed that for a 640-acre Wimmera wheat farm 150 sheep or so are necessary to control weeds on the fallows, trim forward wheat crops, and economically utilize waste roughage. But the experience of the

Sheep Grazing Off 140-acre Paddock of Forage Oats at Mr. F. W. Sallman's (April, 1921).

men quoted demonstrates that this type of farm can be quite successfully managed without the aid of sheep, or with 50 or 60 killers at most. Under this system a relatively high percentage of the farm is cropped to wheat each year. The fallows are so well cultivated that weeds rarely prove troublesome.

For farms of this size, profitable as the system may appear, and feasible as it is in practice, there still remains the question of its ultimate effect on the soil fertility—and that is apparently where it fails.

The experience in the older countries of the world is that persistent grain farming steadily depletes the fertility. Where the produce is fed to live-stock, the loss is not so great, and under certain systems it may even be built up. It would, therefore, seem that where a choice is available, a system of agriculture which maintains the greatest number of live-stock is preferable.

The larger the farm, however, the greater the difficulty of effectively cultivating a big proportion of it. Hence the relatively large area left in grass. Here, then, sheep appear to be an economic necessity.

To sum up, it appears that, from a profit point of view, on small wheat farms sheep may or may not be kept, though from soil fertility considerations their use is advisable. On large farms there is no choice.

Last year there was a pronounced tendency in favour of maintaining and breeding merino sheep, but this year, as a result of the continued slump in wool as against the comparative stability of the prices offered for lambs, the cross-bred sheep of the comeback type and the freezer lamb have come into their own again.

Mr. Hoffman's sheep were a good type of merino ewe, derived from the merino flock of Mr. Gladigeau, of Nhill. Mr. Dahlenburg had 220 merino two-tooth eyes, excellently woolled, and 150 comeback ewes. Mr. Gniel had 70 cross-breds showing evidence of Border-Leicester blood.

Mr. Sallman had 1,500 sheep, comprising 400 merino wethers, and the balance cross-breds; 340 comeback ewes are used as a stud flock. Corriedale rams had been mated with these, producing a large-framed sheep with a reasonably good wool. A line of 200 weaners by these rams from the stud flock was a particularly even and attractive lot.

The Best Cross-bred Sheep in the Competition (Mr. F. Irving's, Sea Lake).

The best line of cross-bred sheep shown was the flock of F. Irving. It comprised 400 six-tooth comeback flock ewes derived direct from Rich Avon Station, 250 one and two year old cross-bred ewes, and 111 three-year-old comeback ewes with 150 last year's lambs. These sheep were of bold blocky type, with excellent frames and broad backs, and were well woolled down the legs. Except for a few killers, they were an exceptionally high class line of cross-breds, and specially suitable for the Mallee.

Mr. Irving, who has associated with him Mr. H. Ross, mated Lincoln rams with the flock ewes, and is using Liewar selected Merino rams on the selected progeny. The ewe lambs are culled to 15-20 per cent. at one year old. The older ewes are replaced with these. The ewes are disposed of at four years old.

Mr. Irving is also the manager of Tyrell Downs Station, and has had considerable experience as a sheep breeder in the Mallee. He finds it essential in a dry year to hand-feed the lambing ewes as soon as they start to spring. Chaff is used at the rate of about 2 lbs. a day.

He is of the opinion that it hardly pays to be bothered with sheep on a 640-acre Mallee block, as the number that can be carried with safety is relatively small. With somewhat larger areas, however, it pays handsomely. That the cross-breds should be of the highest grade obtainable is insisted upon. He recommends the purchase of 4-tooth first cross ewes and their mating with a Lincoln ram, the use of the ewes for three years, and then their replacement.

Cattle.

The number of cattle raised in the wheat belt is considerable. Almost every farm maintains its two or three or more milking cows, as well as a varying number of young cattle. Cattle, then, form an important side line. That being so, it is a matter for comment that the type of cattle kept is not of the best class, either from a beef or a milking point of view. In particular are the sires of poor quality. The use of a cross-bred bull is a common practice. Farmers who keenly appreciate the influence of the sire in breeding horses and sheep and use only the best blood obtainable, are indifferent when it comes to cattle.

The wheat farmer needs awakening to the importance of improving his cattle. Better blood must be introduced into the wheat districts. What is wanted is a dual purpose animal that will milk reasonably well when required, and whose stock can be turned into beef under the conditions that rule in the wheat belt. Both Red Polled and Shorthorn cattle have proved satisfactory for this purpose.

Mr. Dahlenburg is one of those who have established a Red Polled stud. These animals have done well at Salisbury under Wimmera conditions. There, of course, they have access to forage oats specially sown on the stubbles to supplement the natural pastures. On this farm there were 6 Red Polled cows, 4 heifers, and 2 bulls. The balance of the total of 23 head was made up of nondescript sorts.

Mr. Sallman had 5 milkers and 14 other head. Two Friesian heifers have recently been introduced into this farm. This breed is a large-framed animal of a specially high milking capacity. The milk has a moderate cream content. It remains to be seen how they will adapt themselves to Wimmera conditions.

F. Irving had 39 head of cattle, including a pure-bred Milking Shorthorn bull.

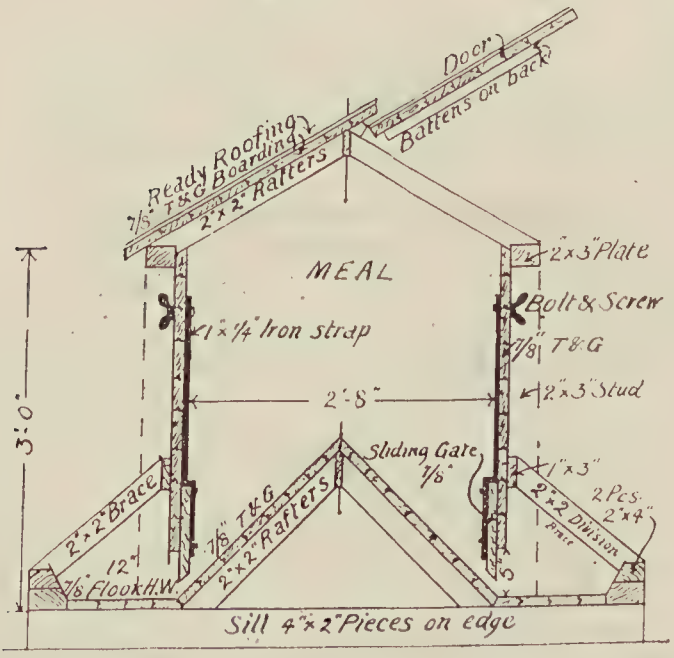
Mr. Sweetman's cattle included one good beef Shorthorn of good type and colour.

The cattle on the remaining farms call for no special mention.

Pigs.

Another useful side line for some wheat farmers is pigs. Many wheat farms are "odd sized," *i.e.*, they are just too large for the plant employed, or the labour available, whether it be one, two, three or more men. On the other hand, the converse is sometimes true. When the latter is the case, it pays to develop some side line that will utilize the spare labour to advantage. Pigs serve that purpose admirably, and they convert waste grain and other material into money as well. Products like oats and barley, when the price is low, often may be fed

[*Australian Farming.*



SELF-FEEDER.

[*Australian Farming.*

profitably to pigs. If provision is made for green crops for grazing, and if the grain for fattening is fed through self-feeders, the labour required is reduced to a minimum.

Mr. Dahlenburg is the only one among the competitors who has made a special department of pigs. The others maintained one or two pigs for house purposes only. On Mr. Dahlenburg's farm three or four Berkshire sows are kept, giving an average of 20 or 30 pigs. The boar is a Middle York. Cross-bred pigs are obtained which make rapid growth, and which are all white in colour.

The pigs are housed in a useful sty with six raised pens and central feed alley. They have access to paddocks of green feed. Barley is the forage preferred; 5 or 6 acres are sown each year on fallow. The pigs are allowed to graze this, and then the paddock is shut up and stripped.

When fattening, the pigs are shut up and fed on cereal grain with a little pollard. Last year barley was used. This year, owing to its low price, oats are being fed, and are giving satisfactory results. The oats are soaked in water. The pigs do well on it, especially if the sample contain a little wheat, as do most samples grown on wheat stubbles last year. Peas is another forage which has been used with success in the Wimmera. Mr. Geo. Batson, of Nhill, finds oats, barley, and peas excellent grazing for pigs. They may be fed in succession. The peas, which are grazed ripe, mature last, and are useful for topping up.

The self-feeder is a labour-saving contrivance which has much to recommend it. The grain is crushed and fed dry. The pigs obtain their water in another receptacle. The self-feeder requires attention once or twice a week only. Mr. Geo. Kerr, of Strathkellar, has constructed a self-feeder and finds it satisfactory in practice. Crushed oats and barley is the feed at present being used in this case.

BUILDINGS, SUBDIVISION, FENCING.

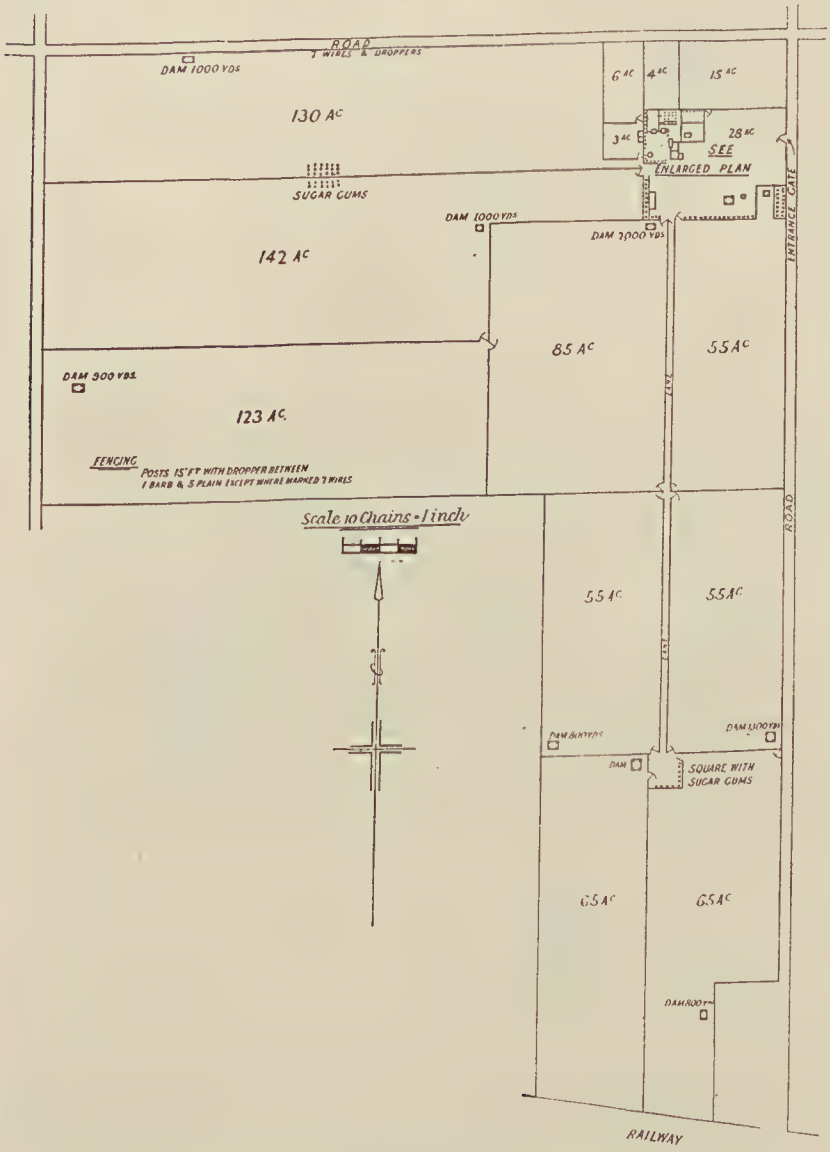
Buildings.

The most important requirements of farm buildings on a wheat farm are briefly—

(1) Effective feeding and stabling of each working horse.
(2) Efficient handling of hay from stack to cutter and thence to store and horse.
(3) Protection from weather, animals, birds, and vermin, of stored foodstuffs, and protection of any implements liable to deterioration.
(4) Provision for rapid and effective repairs to implements.
(5) Provision for catchment and storage of rain water from roof.
(6) Ventilation and coolness in summer.
(7) Moderate cost and durability.

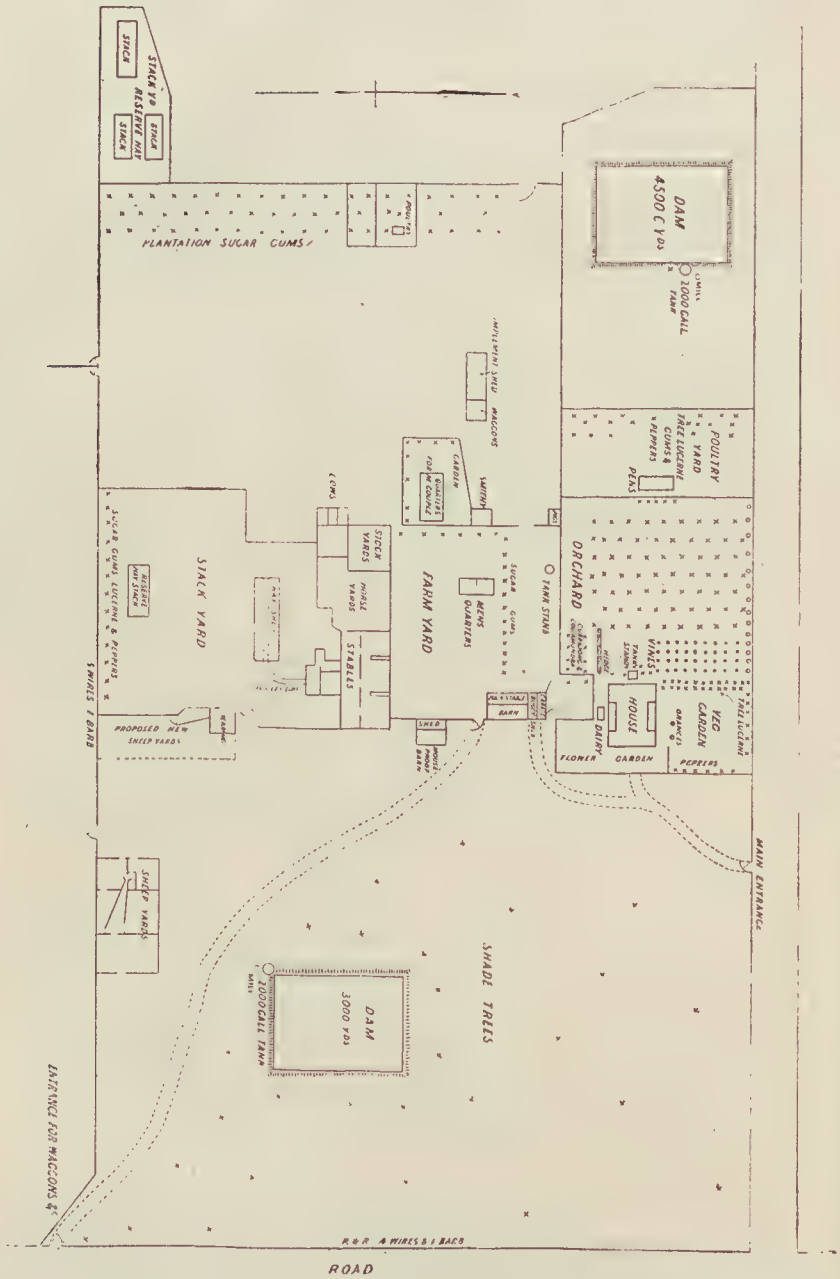
In judging the farms these points were considered, together with the relation of the sites of the buildings to the homestead and the farm as a whole. Particular attention was paid to drainage and the condition of the road surfaces about the buildings. Importance was attached to accessibility to main roads and farm paddocks.

The buildings considered most useful and most effectively arranged were those of Mr. J. Sweetman, Rupanyup. All buildings on this farm are of wood and iron; they are solidly constructed, and are



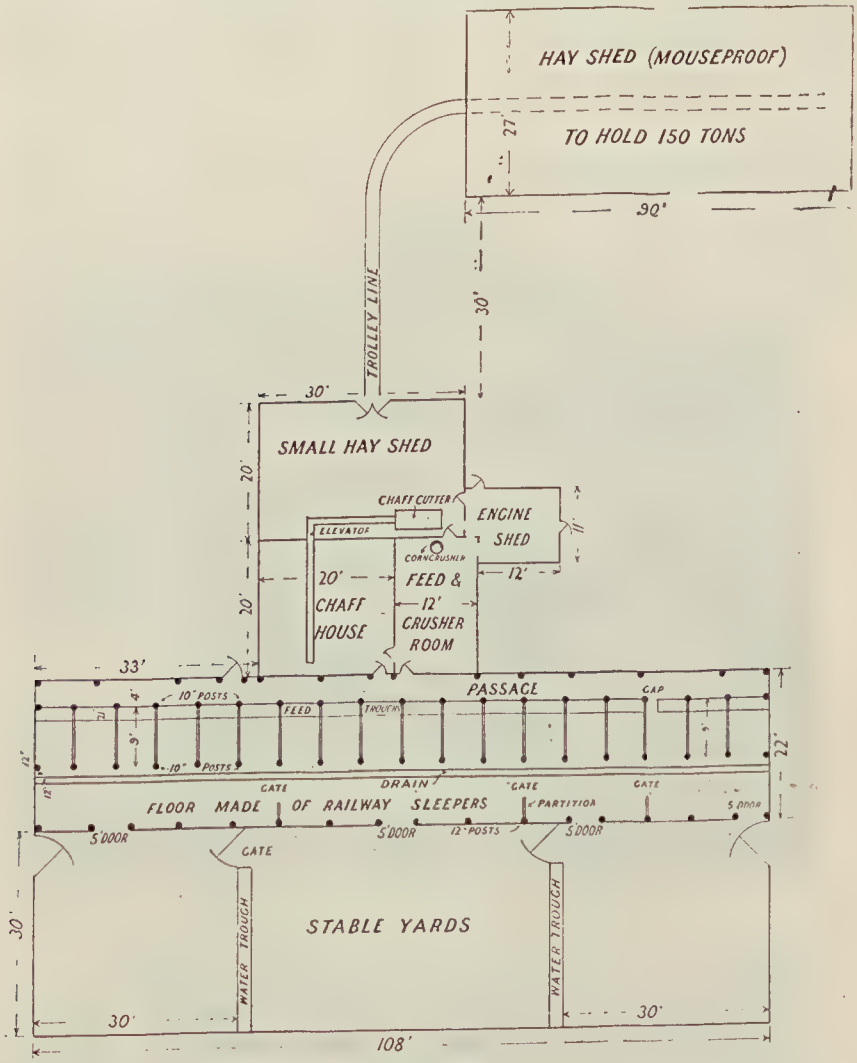
Plan of the Winning Farm—that of Mr. W. E. Dahlenburg, Salisbury.

arranged in the form of a hollow square. This square is planted with well-grown eucalypts, which furnish grateful shade and give comfort to the eye.



Plan of Mr. J. T. Sweetman's Homestead and Farm Buildings, Rupanyup.

Plan of Stable, Chaff-house, Hay-shed, &c., of Mr. J. T. Sweetman.



Specifications.

HAY SHED (mouse-proof) to hold 150 tons, 90 ft. x 27 ft.—Wall 14 ft., gable 22 ft. Roof supported by eight 12 in. poles on either side with one extra in centre of back end. Wall plates, 6 in. x 4 in.; tie beams, 9 in. x 2 in. oregon; rafters, 4 in. x 3 in.; purlins, 3 in. x 2 in. Stack stands on 66 ft. x 24 ft. stand 18 in. high.

CHAFF HOUSE.—Walls of galvanized iron; roof supported by bush posts.

STABLE.—Wall, 9 ft. 6 in. of 10 in. x 3 in. timber; gable, 17 ft. 6 in.; tie beams, 9 in. x 3 in. at each of four partitions; rafters, 4 in. x 2 in.; purlins, 3 in. x 2 in.; brace, 3 in. x 1 in. Roof, galvanized iron supported on 12 in. bush posts.

In laying out these buildings economy in feeding the horses has evidently received careful consideration. The pivot of the feed arrangements is the chaff-house. This is 20 feet by 20 feet, and is capable of holding 20 tons of chaff. It is connected by rail and trolly with a splendid mouse-proof hay shed of 150 tons capacity. Grouped about the cutter room are small hay shed, 30 feet by 20 feet, engine shed, and grain and crusher room. The stable holds eighteen horses—all facing one way. It is 108 feet by 22 feet, and is divided into three separate compartments by gates corresponding to three divisions of the horse yard. By this means the horses may be permitted at night to have access to the yard or stable as they please. The breaking up of the horses into three groups of six reduces to a minimum the possibility of mutual interference. The feed passage occupies 4 feet, the mangers 2 feet, the stalls 8 feet, and the rear passage 8 feet. The mangers are well constructed. The floor is paved with sleepers. A

Mr. Sweetman's Chaff-house, Stable and Barns.

fault that was noticed was a tendency for urine to accumulate under some of them.

A separate stable handy to the home is provided for the buggy horses. Here also is the buggy shed and a feed supply.

In addition there is a mouse-proof barn 15 feet by 30 feet and 12 feet high, of 1,000 bags capacity, as well as a large manure barn and store-room.

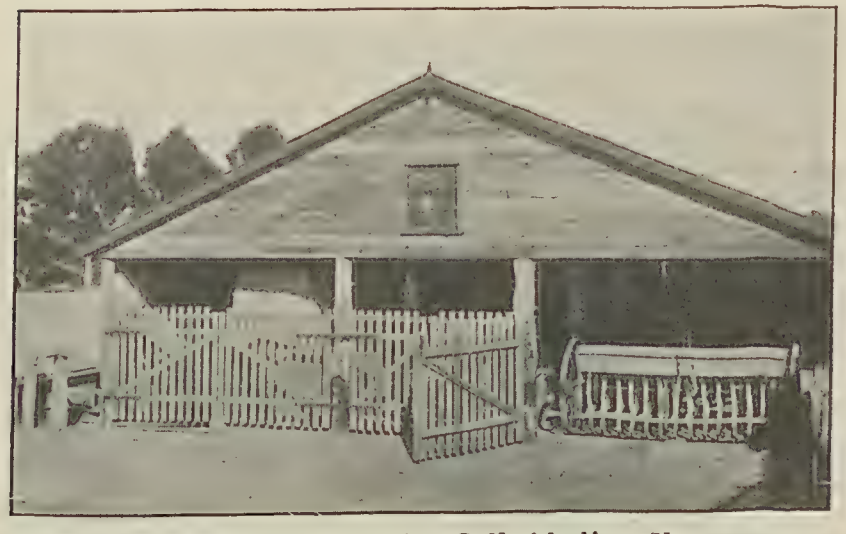
The implement shed is 21 feet by 45 feet. It is totally enclosed. This is necessarily inconvenient, but has advantages for implements liable to damage by dust and exposure to weather. A tall annexe, 21 feet by 21 feet, is provided for the waggon, so that it can be sheltered without unloading.

The smithy, 20 feet by 20 feet, is placed close to the implement shed. It contains an adequate supply of bolts, nuts, duplicates, and full set of tools, and has a timber rack. There is also a wool-shed.

The improvements on the farms of Messrs. W. E. Dahlenburg and R. C. F. Gniel were fully described in last year's report. In the

interim Mr. Dahlenburg has made useful additions to his implement shed.

Other noteworthy buildings in the competition were those of Mr. Geo. Nettlebeck, of Dimboola. Second-hand sleepers had been extensively used in the walls and floors. The layout is compact and convenient, and attention had been given to metalling the road surfaces about the buildings.



Neat Type of Implement Shed at Mr. G. Nettlebeck's. (Note gates to prevent access of wandering stock.)

Stud Stock Stable at Mr. F. W. Sallman's, Dimboola.

A feature of the stable on this property is the method of pitching the floor. The sleepers are laid at right angles to the direction the horses require to travel, both in the passage ways and in the stalls.

The implement shed, 33 feet by 30 feet, is of good type. It is open to the front, but wandering stock are prevented from entering it by gates. The three-bail cowshed, 27 feet by 18 feet, is the best noticed in the Wimmera so far. It is well pitched and drained, is accessible

in wet weather without inconvenience, and has provision for the storage of a reasonable supply of feed.

A feature of Mr. Sallman's buildings is the stud stable. This building is of iron. It is 160 feet by 58 feet, by 28 feet high. It contains numerous loose-boxes for stud stock, sick bay, and quarters for stud groom. The loose-boxes are grouped on either side of a covered passage 30 to 40 feet wide.

Both on this farm and on that of Mr. E. Hoffman, electric light had been installed in the stable. By means of globes on standards, Mr. Hoffman can flood the farmyard with light as well.

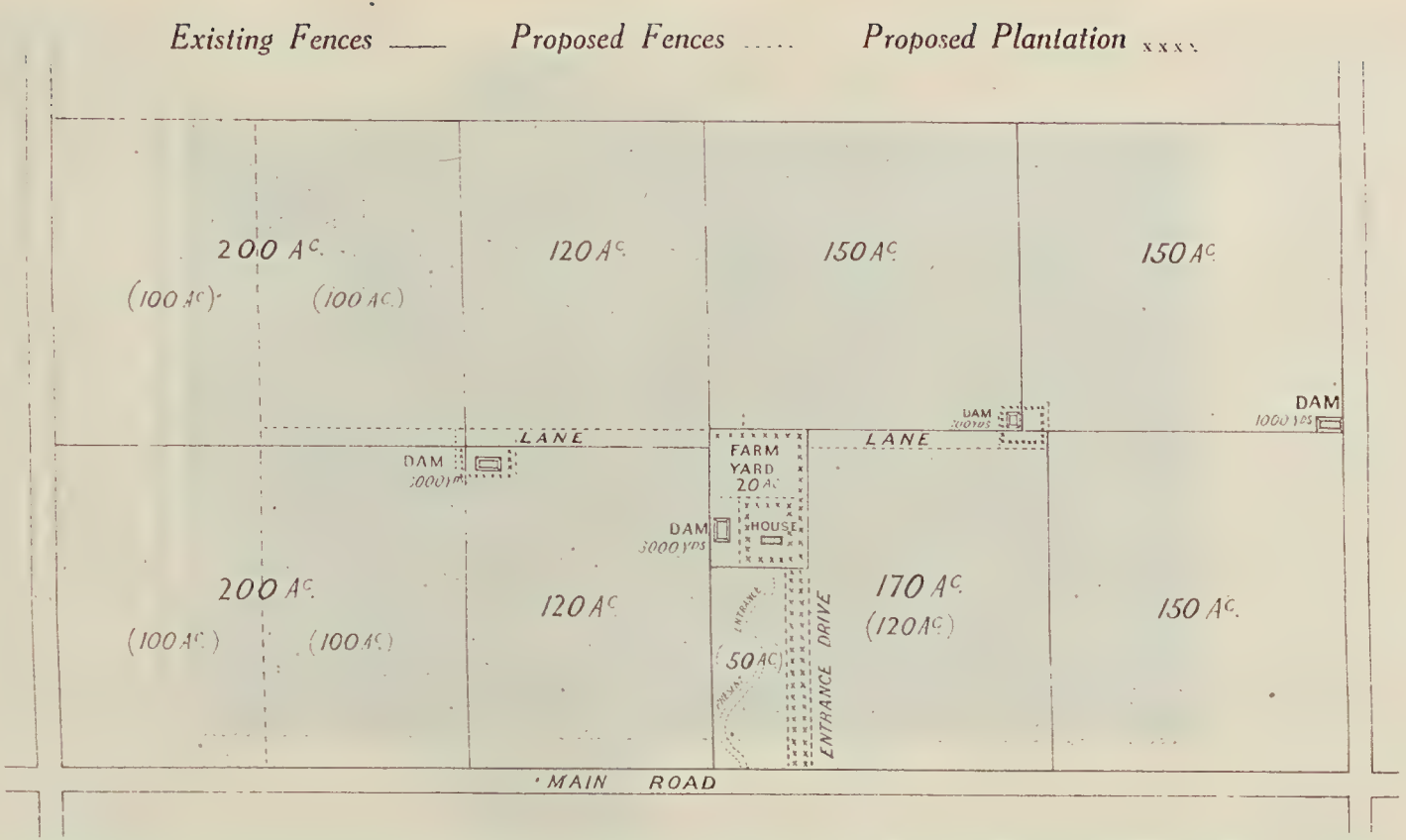
On some of the farms the buildings were constructed of bush timber and were thatched with straw. As a roofing material straw has the advantage of cheapness and of being cool in summer. On the other hand, it is highly inflammable and it harbours birds and vermin. It is not permanent, neither does it permit the collection of rain water. During the pioneering stage these bush structures are often an economic necessity. On a well-improved farm they are out of place.

Substantial 18-horse Stable—Mr. J. T. Sweetman's (see plan on page 407).

The best buildings of the bush type were those of Mr. W. R. Hemphill. They were neatly constructed, well thatched, and conveniently arranged. The stable recently erected by Mr. F. Irving on his Mallee farm at Sea Lake, shows the perfection to which bush carpentry can attain. It might well serve as a model for structures of this sort. Straight Murray pine poles had been used throughout. The walls were of paling. The dimensions were 47 feet by 27 feet, with 14 feet at eaves and 16 feet at gable.

Subdivision.

The factors taken into account in awarding points for subdivision were fully discussed in last year's report. None of the competitors has, perhaps, an ideal method of subdivision, though that of Mr. Dahlenburg is very good. Only one of the paddocks is not directly accessible to the farm yard and the permanent water there. The paddocks are



Sketch Plan of Mr. H. Brennan's 1280-acre Farm at Sea Lake Illustrating Simple Type Sub-division and Expansion Possible in Future.

of good shape, and a reasonable number of them of equal size. The areas are such that a rotation system can be followed which gives reasonably similar areas under crop each year. A feature of the subdivision of this farm is the lane by which the various paddocks are rendered accessible to the farmyard and to each other. At one end of the lane is a square planted with sugar gums.

Bush Stable of Murray Pine, Showing Neat Workmanship (Mr. F. Irving, Sea Lake).

The fencing is good, though the use of iron droppers on some of the lines is open to criticism. There are 21 excellent gates of sawn timber. These are well hung, and each is provided with two sets of chocks and rests. A number of the competitors had recently erected considerable lengths of new fencing. The popular fence is constructed of box posts with six plain wires and one barb, with split buloke droppers of respectable dimensions. Iron droppers are easily bent

by stock or swinglebars, and are liable to break when straightened. Sawn droppers snap off short when subjected to the least stress.

The simplest subdivision seen was that adopted by Mr. H. Brennan, of Sea Lake. The farm is oblong in shape, and lends itself to a straightforward plan. There are two paddocks of 200 acres, two of 120 acres, three of 150 acres, and one of 170 acres. The home paddock is 20 acres. By means of two short races this design could be easily made a most effective one.

MACHINERY.

A survey of the capital investments on the eleven farms shows that an average of £817 was invested in plant. On the small Mallee farms the money invested in plant represents nearly 15 per cent. of the total investment. On the largest farm it is barely 4 per cent. These figures are the book values of the plant after allowing reasonable depreciation. If anything, the value is higher at the present time than the figure taken. It must be admitted that the money locked up in plant is considerable, nor are there any indications that the burden is likely to be any lighter in the future.

Sowing Forage Oats with the Combined Cultivator Drill (Mr. E. Hoffman, Nhill).

An up-to-date plant is the rule on most wheat farms, and the trend is towards the largest and most economical type of implement available. There is fortunately considerable activity among machinery firms, assisted by farmers of an inventive bent. New implements are constantly being produced. The headers and reaper-threshers have firmly established themselves in the field. Their large capacity and their efficiency in coping with tangled crop and weeds render them superior to harvesters on most farms.

The combined spring-toothed cultivator drill is the latest implement on the market, and it has already demonstrated itself as a useful labour-saving implement on many Wimmera farms. In clean ground it has undoubted advantages, and crops sown by it have occupied prominent positions in the competitions. The tractor does not make much headway.

Most farmers are content to depend entirely upon implement firms for their labour-saving devices; but not a few show surprising inventive

skill. A neat method of yoking horses tandem fashion was noticed on one farm recently. Instead of the objectionable equalizer bars sometimes attached to the hames of the rear horses, the equalization is secured by means of a binder cog and short piece of binder chain. The cog is fastened to the rear chain. The binder chain is attached to the hames of the rear horse, thence it passes round the cog and forward to the leading chain. An erratic horse easily renders the ordinary equalizer ineffective, but not this. This idea also does away with long chains and heavy pulleys.

Mr. Hemphill had neat canvas covers tacked on to the lid of his drill. Mr. Dahlenburg had a home-made elevator, and had altered a spring-toothed cultivator so that the depth at which it works might be more effectively controlled.

Mill Wheel Home-made Automatic "Cut-off" (Mr. W. R. Hemphill, Rupanyup).

The most complete plants were possessed by Messrs. Dahlenburg and Sallman. Mr. Dahlenburg's was described last year. Mr. Sallman's consisted of Taylor header, 9-ft. harvester, 8-ft. harvester, thresher, two combined spring-toothed drills, two 15-hoe drills, 8-ft. binder, two six-furrow prong mouldboard ploughs, scarifiers, harrows, hay-rake, 14 h.p. engine, large chaff-cutter, corn-crusher, winnower, stack elevator (home made), saw bench, wool press, waggon, &c., &c. It was observed on this farm that necessary duplicates had already been installed in the binder with a view of obviating delays later in the year.

A fault frequently noticed during the inspection was worn jaws in the chaffcutters, leading to poorly cut chaff. Mr. Jackson had a powerful four-bladed cutter, which made an excellent sample. On one farm the chaffcutter was obsolete.

WATER STORAGE.

Judged by old-world standards, the wheat belt is a region of few rivers and scanty rainfall. With well-prepared fallows that is no handicap for wheat growing; but there was a time when the territory was unsafe for stock in dry seasons. Private and public enterprise has overcome that disability. Government channels now serve 13,000,000 acres, in

Victoria. Private enterprise has sunk many thousands of dams, wells, and bores. On some farms the capacity of the storages is still inadequate. In dry years water may have to be carted from the nearest public supply. Nothing disorganizes the farm routine so much as water carting. Neither can a garden be maintained nor an unfailing supply provided for domestic purposes without reasonable storages. For a quarter of an acre of garden and for washing purposes the main dam should be at least from 4,000 to 5,000 cubic yards, though with economy 3,000 yards has sufficed. Ten thousand cubic yards is an ideal to be aimed at. With wells or bores, of course, there is not the same necessity for large storages, though water from this source is frequently mineralized, and hence not entirely suitable for house and garden.

In the paddocks, dams of at least 1,000 cubic yards capacity are required. If less than that they are liable to give out at critical times. An economical method of watering paddocks, where it is practicable, is to place the dam at the junction of several fence lines.

In many cases the existing storages are large enough, but they are constructed and used without regard to the best principles of conserving water. The dams should be at least 12 feet deep, with the sides as steep as the scoop horses can negotiate. The object is to present the minimum surface for evaporation, which is from 4 to 6 feet a year. The excavated dirt should be placed round the top to reduce evaporation. If water is to be stored above ground, the bank must be provided with a clay core keyed into the subsoil. The dam should be fenced, or a paved stock-approach laid. Settling pit and chute will prevent silting. A concrete chute, to prevent erosion, designed by Mr. Gniel, was described last year.

The following table illustrates the varying storages provided by the competitors. Some are evidently far from adequate. From 10 to 15 cubic yards per acre appear to be desirable, even when backed up by Government channels, bores, or wells:—

Competitor.	Area of Farm.	Water Stored in Dams.	Source of Permanent Supply.
	acres.		
W. R. Hemphill ..	513	10 yards per acre	Government channels
G. Nettlebeck ..	544	6 ,, ,,	Nil
R. C. F. Gniel ..	639	9 ,, ,,	,,
R. Jackson ..	690	11 ,, ,,	Government channels
E. Hoffman ..	760	6·5 ,, ,,	Bore
W. E. Dahlenburg	840	14 ,, ,,	Well, 160 feet deep
M. Brennan ..	1 280	7 ,, ,,	Government channels
J. Sweetman ..	1,480	15 ,, ,,	,, ,,
R. McCollim ..	2,460	4 ,, ,,	,, ,,
F. W. Sallman ..	2,448	9 ,, ,,	Government dam near Government channels
F. Irving.. ..	3,000	2 ,, ,,	,, ,,

All competitors but three had installed windmills, and had water laid on to house and garden. The most comprehensive systems were those of W. E. Dahlenburg and J. Sweetman. Mr. Gniel's was nearly as good, but supplies are needed in some paddocks. Mr. Sallman has a splendid supply for domestic purposes. The home dams are two, one of 5,000 cubic yards, which can be filled above ground to a total of 11,000 yards. The banks have a core of pugged clay. The other is 2,000 yards. There are three mills; one of them lifts rain water to an overhead storage for use in the hot-water system.

Mr. Dahlenburg's supply was described in detail last year. The central feature is a well 4 feet x 2 ft. 3 in., 160 feet deep, of the best type of construction. It is timbered with redgum, and is provided with "box" and "chamber." A 14-ft. mill on 30-ft. tower actuates a 3½-in. pump, which lifts the water into a 3,000-gallon tank on a 20-ft. stand. There is a 2,000-yard overflow dam. This well delivers 700 gallons per hour, as it was sunk until it was impossible to keep the water down with an engine delivering that quantity.

At Mr. Sweetman's, two home dams comprise 7,500 yards between them. There are two mills, one on a 40-ft. tower, and one on a 20-ft. tower. There are three 2,000-gallon tanks on stands; one acts as a stand-by. Ingenious automatic cut-offs have been designed and installed by Mr. Sweetman. They are of the float and lever type.

A Comfortable Homestead—that of Mr. F. W. Sallman of Dimboola. (Note the 11,000-yard dam.)

Mr. Hemphill is another who has constructed an automatic cut-off. When the tank is full the water flows through a smaller tube into an oil drum, the added weight of which actuates the cut-off. Conversely, when the water level is lowered the mill starts.

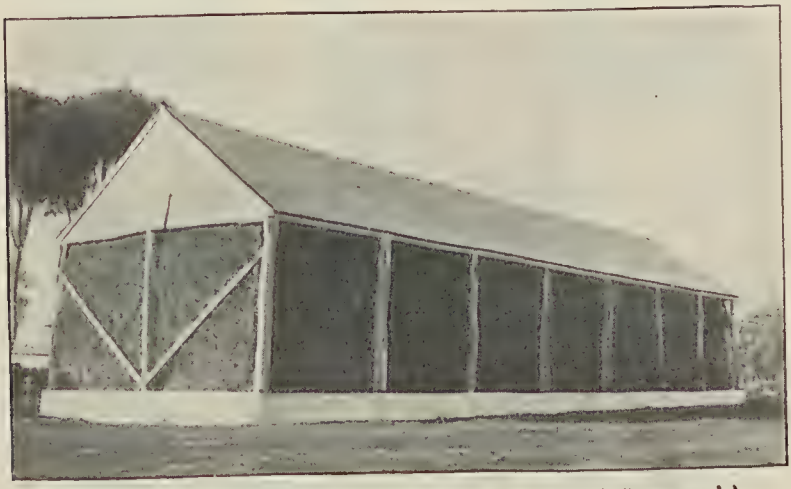
Mr. Nettlebeck has succeeded in dispensing with the windmill altogether. The house dam is on the top of a hill. By means of a float the suction pipe is kept beneath the surface of the water in the dam. The water syphons naturally to the house at the lower level. Some of it is elevated by a pump to a tower when the engine drives the chaffcutter.

FODDER RESERVES.

For the first time since the mouse plague can it be said that there are ample supplies of hay on hand in the wheat belt. Most of the competitors had more than enough for two years, and they had taken precautions to protect it by approved method from damage by mice and weather. It was noticed that the best quality hay was always that

obtained from Algerian oats grown on fallowed land. Where wheat is relied upon, especially in the Mallee, there is a tendency to cut the hay on the ripe side. Consequently, the grain is fully mature and the straw harsh, brittle, and innutritious. Most farmers in the wheat belt have a lot to learn from the down-country hay-grower in the art of stack building. The stack must be kept well hearted up, well sprung, and the roof should have ample pitch. Round-ended stacks are easier to build than square-ended ones. The use of temporary poles at the corners is a help to the amateur builder of a square-ended stack.

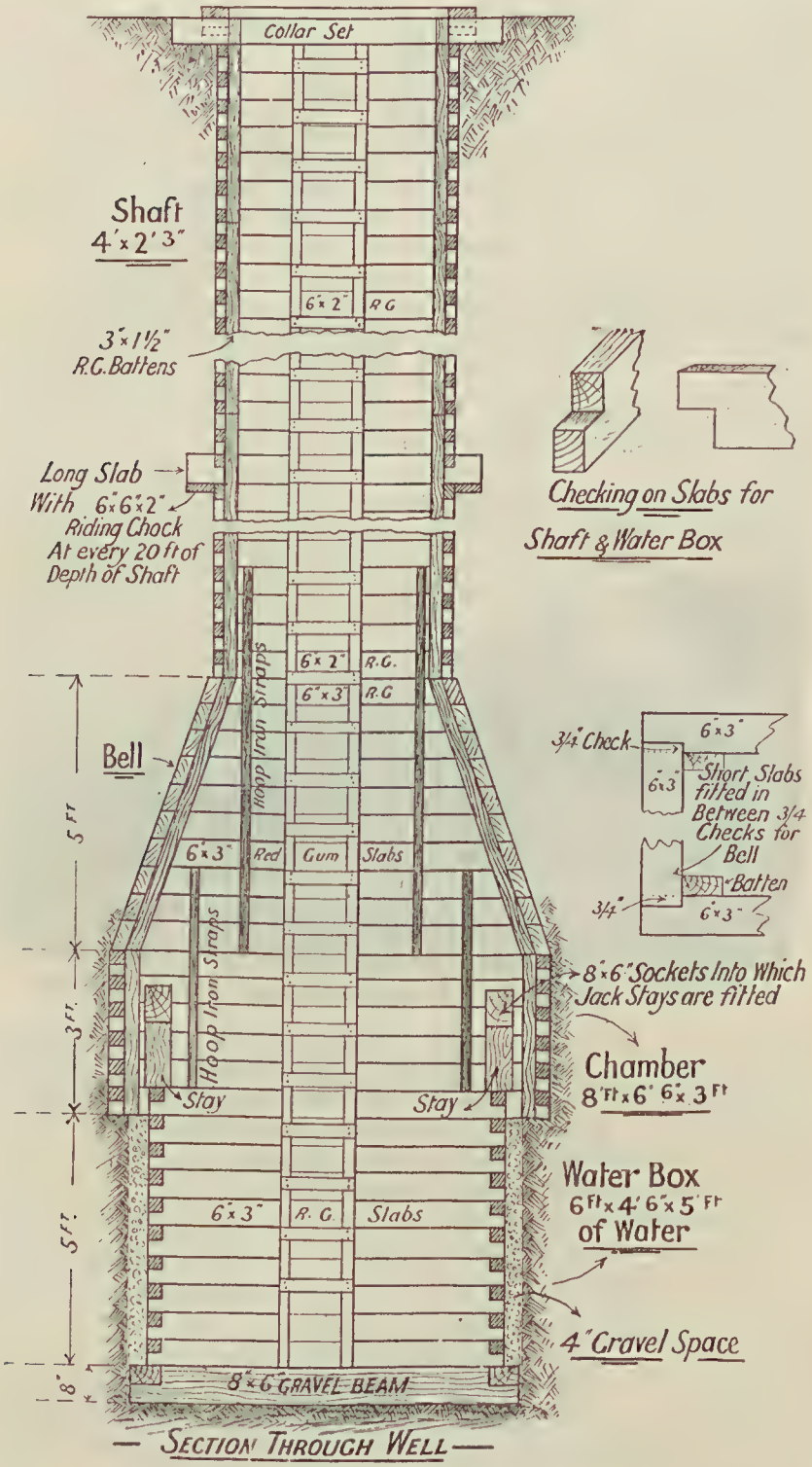
The best fodder reserves and fodder conservation arrangements were seen at the farm of J. Sweetman. There were 300 tons of hay of superfine quality, 50 tons of self-sown hay, and 100 bags of oats. The central feature of the reserves is a hay-shed, which holds 150 tons. A trolley line traverses the shed from end to end, and thence to the cutter room. The dimensions of the hay-shed are 90 feet x 27 feet; the walls are 14 feet high with 8 feet extra to gable. Bush posts of 10 to 12-inch



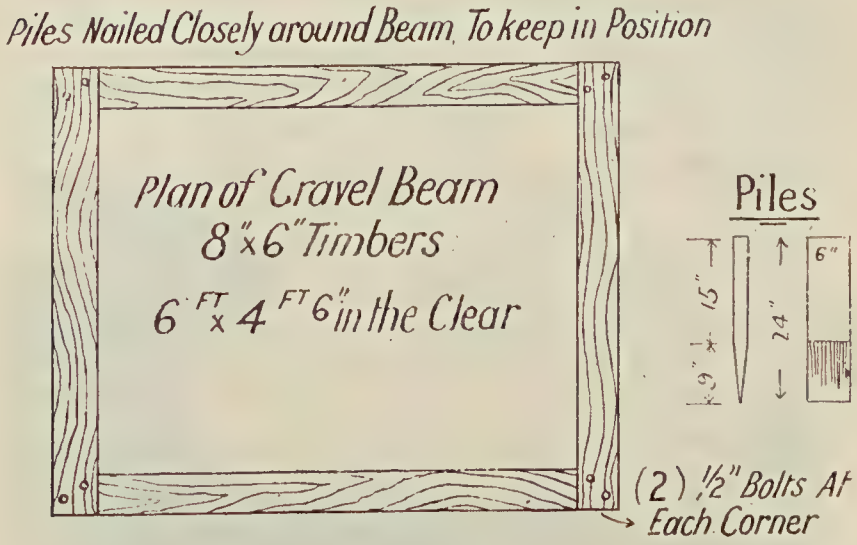
Fine Mouse-proof Hay-shed to hold 150 tons (Mr. J. T. Sweetman's).

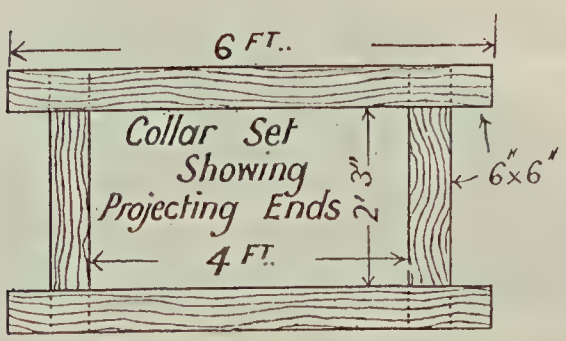
diameter are used for the uprights. They are sunk 3 feet in the ground. The wall-plates are 6 inches x 4 inches, the tie-beams 9 inches x 3 inches. Suitable stays are also provided. It is estimated that the shed would cost £200, but a great saving in labour and in hay results annually. The shed runs east and west; 40 sheets of plain iron 2 ft. 6 in. x 6 feet, tacked to the uprights, totally enclose it from mice.

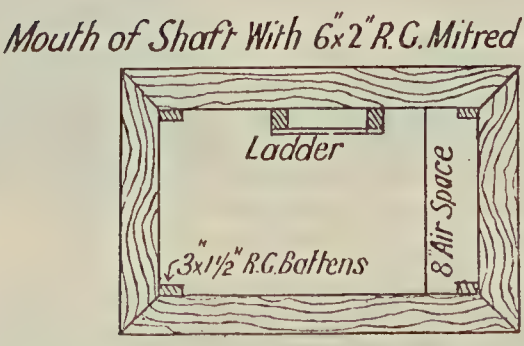
Mr. Dahlenburg had 320 tons of hay and 350 bags of oats stored in a corrugated iron silo. The silo is 13 ft. 6 in. diameter by 12 feet high. It stands on a 4-ft. section filled with sand. The roof is supported with eight perpendicular stays, which are mouse-proofed. The oats are whipped up to the landing stage by the aid of a pole. All stacks other than those in use have been mouse-proofed with corrugated iron. When corrugated iron is used, it is important that special overhanging plates be provided at the joints of the sheets. Corrugated iron has the advantage of being more rigid and cheaper than plain iron. For 100 tons of hay on a 24-ft. x 63-ft. base the following materials are required:—23



Plan of a Farm Well.







Specifications for the Construction of the Well Designed in these Plans were published in the *Journal of Agriculture* for October, 1920.

sheets 8 x 2.6 iron, 23 posts, 3 x 2 jarrah. Nail plates to the posts. The cost is about £15, inclusive of labour.

Some of the competitors had stack stands, but, as a rule, they are difficult to maintain mouse-proof, and involve extra pitching when building the stack. Mr. Jackson had one for 60 tons. The posts were split box, 8-in. diameter. Sixty placed 4 feet apart each way are required. Sheets of flat iron 2 feet square rest on these. On top, again, are the bearers 4 feet x 3 feet. The planking is 6 feet x 1 foot.

THE FARM HOMES.

There is no doubt that a great movement has set in in the wheat belt towards better living conditions. The pioneering stage and the primitive mode of living associated with it has been long left behind, except in the new Mallee. Many well-to-do farmers, however, have been loath to spend money on the country home. They regarded the country as

Mouse-proof Enclosure of Corrugated Iron—Mr. W. E. Dahlenburg's, Salisbury (see specifications, page 417).

the place to make the money; the city as the place to which to retire and spend it.

Now, however, a distinct change is occurring. Up-to-date houses, with lighting systems, piped water supply, telephones, and other comforts are being rapidly erected. It is a healthy sign, and indicates the growth of a desire to regard the farm as a permanent home. That is the first step towards building up a progressive rural community, whose instincts and traditions are of the soil, and whose ideals are sound farming.

In awarding points for the homes, both the æsthetic and the utilitarian sides were considered. Shade trees and flower gardens were regarded as important. The complete segregation of the live stock from the immediate vicinity of the home, and means of confining them to definite portions of the farmyard were regarded as essential. The provision of a well laid-out entrance drive planted with trees received

encouragement, especially where a well-designed gate leading from the public road had been installed. Marks were deducted where lighting system, telephone, fly-proof doors and windows, piped water supply, covered wash-house, &c., cool cellar, &c. &c., were absent.

The most attractive farm home in the competition was that of Mr. F. W. Sallman, of Dimboola. There is a fine entrance drive, attractive

Well-Sheltered Homestead and Farm Buildings of Mr. J. T. Sweetman, Rupanyup.

Shady Entrance Drive at Mr. F. W. Sallman's, Dimboola.

garden, and splendid shade trees. Among the many conveniences installed are electric light and hot and cold water system.

Mr. Hoffman also has the electric light. In the garden there was a fine dispay of chrysanthemums at the time of judging.

Mr. Nettlebeck's home, which is built of sandstone, obtainable almost anywhere in the Wimmera, compares favorably with any city residence. There is a splendid cool cellar.

Mr. Jackson has a new house, in which is installed a new petrol gas plant with boiling burner. All the most attractive homes had separate entrances for light and heavy traffic.

Mr. Dahlenburg had the best orchard. Mr. Hemphill had a magnificent vegetable garden. Some 1,600 lbs. of tomatoes were taken from this garden last summer. Mr. Gniel's home was a revelation of what can be done in nine years in virgin Mallee.

ANALYZING THE FARM BUSINESS.

The capital invested in the eleven competing farms ranged from £3,700 to £36,800, and averaged £14,150—not inconsiderable sums of money.

Invested in gilt-edged securities, such as war bonds, at 6 per cent., the income received for the respective amounts would be £222 and £2,208, and the average £849. In this case no risk, worry, or super-

Attractive Homestead Constructed of Local Sandstone (Mr. G. Nettlebeck, Dimboola).

vision would be entailed. The income would be regular, and the asset easily convertible. Unless the farm is returning something over and above a fair rate of interest, say 5 per cent., the farmer is really working for nothing.

In comparing the farms as business propositions, this fact was borne in mind. The "labour income," that is, the income after deducting 5 per cent. on the capital, was determined in each case. Comparisons were then made on a sliding scale, because it was recognised that farms with such widely differing areas and capital investments were essentially propositions of a different class.

DETERMINING THE LABOUR INCOME.

Use was made of authentic copies of the Federal income tax sheets to determine the difference between revenue and expenditure. The period taken was 1917-18, 1918-19, 1919-20. Due allowance was made

for the residual value of the wheat scrip. The figures given represent the average income earned in each of the three years. In two cases the returns were available for a lesser period only.

The capital investment was determined on the spot. The farm was valued on the basis of strictly normal values for the district at the beginning of the period under discussion. These values are lower than those prevailing recently. In the capital investment the following items have been included:—

(1) Land and improvements.
(2) Plant and implements.
(3) Live stock.
(4) Average fodder reserves.
(5) Cash required to run the business.

In arriving at the difference between the revenue and expenditure, the following items were included:—

REVENUE—
Wheat and hay, wool, hides, &c., value of net increase in live stock, value of net increase in fodder reserves, sundries.

EXPENDITURE—
Wages and board, bags, manure, twine, oil, &c., depreciation, repairs, sundries.

SOME DEDUCTIONS FROM THE SURVEY.

In publishing the following tables, the figures for two of the farms have been suppressed, so that it will not be possible to identify the competitors from them. This course has been followed because the returns were obtained in strict confidence.

The survey disclosed that for the three years the whole of the competitors earned 5 per cent. per annum on the capital investment, and sums ranging from £285 to £1,069 a year as well. The additional sum earned averaged £631 per annum. These figures are higher than those for last year. That is accounted for by the fact that these were years of high prices for wheat; 1918 and 1920 were prolific seasons but 1919 was a lean year on most wheat farms, though some of the competitors did well by selling hay at good prices.

It should be remembered that the figures submitted are those of some of the best farmers in the wheat belt; they are, therefore, probably much above the average.

When the average yields for the districts are compared with those of the competitors there are differences averaging 8 or 9 bushels in favour of the competitors. If the expenses are at all comparable it is probable that the "labour incomes" on numbers of wheat farms are below those quoted. Possibly in some cases they disappear altogether.

The interest earned on the capital ranged from 14.5 per cent. down to 7.4 per cent., and averaged 10.7 per cent. No allowance of 5 per cent. on capital was made in this calculation. In considering the farms as a whole it became very evident that the larger the farm and the capital investment, the smaller the rate of interest earned on the investment. The labour income increased with the size of the proposition, but very slowly indeed.

This is strikingly shown in the following table, in which nine of the farms have been arranged in order of size:—

Nine Farms, in order of Increasing Size.	Capital Invested.	Income.	Rate of Interest earned on Investment.	Labour Income.
	£	£	%	£
A—Below 1,000 acres	7,393	1,062	14·3	693
B " "	6,543	924	14·1	597
C " "	3,708	470	12·7	285
D " "	9,970	1,189	11·9	691
E " "	9,640	1,386	14·3	904
F " "	10,765	983	9·1	445
G—Above 1,000 and below 3,000 acres	7,550	652	8·6	275
H " " " "	15,971	1,586	9·9	788
I " " " "	24,550	2,058	8·4	831

These figures appear to show that the large farm is at a decided disadvantage from an investment point of view, though it must be admitted that it is a well-known fact that the larger the investment the more difficult it is to earn a high rate of interest. In any case the investment earns a comfortable income. But the decline in the rate of interest earned indicates that the large farm is comparatively inefficient under the conditions that rule in the wheat belt.

There are a number of factors operating against the economical management of the large farm. The hired labour is not so effectively supervised; the expenses for wages are generally much greater in proportion; it is difficult to cultivate the same proportionate area, and to cultivate it so well. Thus relatively more of the big farm is grazing sheep, and the wheat yields per acre are generally lower. The big profits come from the cultivation of wheat and from high yields per acre.

Wimmera land carried from two-thirds to one sheep to the acre; for that purpose its value would be £5 or £6 per acre at the outside, but the farmer has to pay from £10 to £15 for it at least.

It has already been stated that each horse on the large farm is expected to cultivate a much greater area annually than on a small farm. This should lead to greater business efficiency, but possibly the extra area cultivated is gained at the expense of thorough cultivation. The inference is that this also, in part, is the explanation of the lower rate of interest earned.

Methods by which the large farmer may seek to improve the efficiency of his business have been outlined in previous sections. Briefly to summarize them they are—(1) increase the carrying capacity of grass land, (2) improve the quality of the live stock, (3) improve the efficiency of the labour.

If the owner of the large farm, by selling half his farm, can re-organize the remainder and earn 14 per cent. on the capital, he could then invest the proceeds of the sale in the war loan at 6 per cent. The net return would then average 10 per cent. as against 7 or 8 per cent., *i.e.*, a net gain of 2 or 3 per cent.

In order to illustrate the differences between the business efficiency of large and small farms, two typical cases, not necessarily those of

competitors, have been selected for consideration in greater detail. The large farm is just about double the area of the small one, and the quality of the land very similar.

Capital Investment.	Large Farm.	Small Farm.
Land and improvements	£14,760	£7,600
Live stock	901	560
Plant and implements	1,000	625
Average fodder reserves	650	525
Average cash required	660	330
	£17,971	£9,640
5 per cent. of capital ..	£898	£482

In the following table a column is shown in which the items for the large farm have been divided by two, so that direct comparisons may be made on an equivalent basis:—

INCOME.

REVENUE.

	Large Farm. Actual items.	Large Farm. Items divided by 2.	Small Farm.
Wheat	£2,221	£1,110½	£1,350
Hay and other grain ..	6	3	12
Wool	227	113½	155
Milk, eggs, cream, &c. ..	59	29½	48
Other	3	1½	—
Net increase in live stock ..	100	50	203
Net increase in fodder ..	23	11½	69
	£2,639	£1,319½	£1,837

EXPENDITURE.

Wages and board	£389	£194½	£125
Seed, manure, bags, oil, twine	299	149½	210
Depreciation	50	25	36
Repairs	57	28½	47
Sundries (rates, taxes, &c.) ..	158	79	33
	£953	£476½	£451

CALCULATING THE LABOUR INCOME.

Revenue	£2,639	—	£1,837
Expenditure	953	—	451
Income	£1,686	—	£1,386
5 per cent. on capital ..	898	—	482
Labour income ..	£788	—	£904

The interest earned on capital by the larger farm approximates 9½ per cent., and on the smaller 14½ per cent. The labour incomes are £788 and £904, respectively.

Comparing the corresponding items, it will be noted that in every item of revenue the large farm is at a relative disadvantage, while little or no corresponding savings are made in expenditure. Indeed, the items wages and board and taxes are relatively greater. Seed, manure, &c., appear to cost relatively less on the large farm. The extra cost of bags

Melons in the Mallee. Grown on fallow by Mr. R. C. F. Gniel, Walpeup.

and manure for the proportionately greater area cultivated on the small farm appears to be the explanation.

An interesting deduction that can be made from the foregoing considerations is that the small man can afford to pay higher prices per acre than the large man.

An attempt has been made to determine the cost of production of wheat from the facts obtained during the business survey. This will be made available at a later date.

IMPROVEMENT OF FARM CROPS BY SELECTION.

(*A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.*)

Address Delivered at Annual Convention of Chamber of Agriculture, Sale, April, 1921.

One of the most remarkable and interesting features of modern agriculture is the extraordinary activity displayed in plant improvement throughout the world. Almost every type of farm crop has been subjected to a very critical study, with a view of determining the best methods of improving it both in yield and in quality.

Yield Per Acre Steadily Increasing in Other Countries.

The yield of farm crops per acre has been steadily increasing in the older agricultural countries of the world. Thus in Europe the increase in the yield of wheat, barley, oats, and potatoes during the 25 years prior to the war has ranged from 33 per cent. to 50 per cent., and in some countries, notably Germany, the average increase ranges from 60 to 75 per cent.

In the United States, a country whose agriculture more closely resembles our own, we find, notwithstanding the fact that the progress of settlement has necessitated the utilization of immense areas much poorer than hitherto cultivated, the yield per acre has been materially increased.

Thus comparing the quinquennial period 1886-90 with the five years ending in 1915, we find that the increases in yield per acre have been as follows:—

Wheat	30 per cent.
Oats	27 per cent.
Barley	21 per cent.
Maize	12 per cent.

The lower increase in maize has been due to the fact that extensive cultivation of drier and poorer areas has especially militated against high yields of this moisture-loving plant.

These increases in average yield per acre, both in Europe and America, are striking illustrations of progress and development.

Yields Per Acre of Farm Crops in Victoria.

When we compare the yields of these same crops in Victoria during the past five years with those obtained 20 years ago, the comparison is by no means inspiring.

The following table shows the average yields per acre in five-year periods for the past 20 years in Victoria:—

Yield Per Acre. Period.	Wheat. Bushels.	Oats. Bushels.	Barley. Bushels.	Maize. Bushels.	Potatoes. Tons.
1900-1904	8.1	21.2	20.2	65.3	3.0
1905-1909	11.1	21.3	21.4	54.4	2.8
1910-1914	10.2	16.5	20.1	45.0	2.8
1915-1919	13.1	18.6	21.8	43.7	2.7

Average for 10 years.								
1900-1909	9.6	..	21.25	..	20.8	..	59,9	.. 2.9
Average for 10 years.								
1910-1919	11.7	..	17.8	..	20.9	..	44.3	.. 2.71

This table reveals several features of interest. Of the five farm crops cultivated extensively in Victoria, the only one which has shown a substantial increase in yield per acre is wheat. The yield has increased from 8.1 bushels per acre to 13.1 bushels per acre—an increase of 5 bushels, which is approximately 60 per cent.

And this increase has been brought about notwithstanding the opening up during the past 20 years of large areas of Mallee land situated in areas of low rainfall, where the yields during the pioneering stages are necessarily low. These Mallee lands have certainly materially lowered the State's average for the past five years.

On the other hand the average yield of oats has fallen from 21.2 to 18.6 bushels, a decline of 12 per cent. Barley yields have remained practically stationary, but maize and potatoes have fallen in yield by 33 per cent. and 10 per cent. respectively.

It may be argued that a lowering of the yield per acre may be expected as larger areas are devoted to the cultivation of these crops. But other countries have managed to increase enormously the acreages under crop by bringing under cultivation poorer and drier lands, and at the same time they have increased the average yield per acre.

In point of fact, the area sown to barley, oats, and potatoes in Victoria is not very much greater than that sown 20 years ago.

On the other hand, the acreage under wheat has increased by 750,000 acres during the last 20 years, and most of this increase has included the drier and relatively poorer lands of the Mallee, which 20 years ago were regarded by many as hardly worth saving. It appears, then, that while there has been a substantial increase in the wheat yield, the average yield of other farm crops has shown a decline.

Cause of Improvement in Wheat Yields.

Wheat is the one crop which can be said to have been subjected to systematic and scientific study during the past 20 years, with a view of determining the best cultural methods for insuring success and of producing varieties suited to the varying soil and climatic conditions of the wheat belt.

Hundreds of new types of wheat have been developed as a result of the wheat-breeding activities of the various State Departments, Agricultural Colleges, and private farmers. These have been tested out at experimental farms and farmers' experimental plots, with the result that to-day we have varieties suited to each type of soil and climate in the wheat belt, of high yielding power, and reasonably resistant to fungoid diseases.

The most distinguished worker in this field was William Farrer, a Cambridge University scientist, who laboured as wheat specialist for the New South Wales Department of Agriculture, and finally fixed Federation, which has become the most popular variety of wheat cultivated in Australia. So popular, indeed, has Federation become that Farrer may be said to have changed the colour of our harvest fields

Approaching the Ideal. A Shapely Cob of Maize, with well-covered top and butt.

from golden yellow to dull bronze, the colour of the ear of Federation wheat.

It is difficult to estimate exactly what the introduction of Federation has meant to Australia. So far as Victoria is concerned, we would be well within the mark in saying that the increased yield due to Federation during the last five years is at least one bushel per acre, worth more than £500,000 per annum.

The work which Farrer began has been carried on by many others, one of the most successful of whom is Mr. Pye, of Dookie College, who, in producing the hay wheat Warden and the grain varieties Currawa and Major, has rendered signal service to the wheat-growers of the State.

The varieties of wheat under cultivation to-day certainly gives better yields and are more adapted to the climatic conditions than those in cultivation 20 years ago.

Side by side with the development of improved varieties there has been a decided improvements in cultivation methods. The improvement has come about by clearer recognition of the factors essential for success in wheat culture. These factors may be summarized as—

(1) The use of a well-worked moisture-saving fallow as a preliminary preparation for wheat.

The percentage of wheat sown on fallow land in Victoria has steadily increased from 28 per cent. to 61 per cent. in 20 years. The farmers of the Wimmera have the largest proportion of fallow to wheat, the percentage

being over 80 per cent. On the other hand, the great Mallee province, which is destined to become Victoria's granary, has less than 40 per cent. of its wheat crop sown on fallow, though the need for fallowing is much greater, on account of the rainfall being less than in the Wimmera.

Much of the Mallee area is still in the pioneering stages, but as this country is finally cleared of mallee shoots and stumps, and the systematic fallowing methods of the older lands adopted, the average yields will be lifted from 25 to 50 per cent. above those obtained at the present time.

(2) Not only has the relative area under fallow greatly increased during the past 20 years, but the fallows have been more intelligently worked, primarily to conserve moisture, but also to make a fitting seed-bed for the reception of the seed in autumn.

(3) The quantity of soluble phosphates used has been rapidly increasing. The number of farmers using superphosphate in Victoria has increased from 11,000 in 1901 to 33,000 in 1919, and the quantity of fertilizer used per acre has greatly increased.

(4) Good systems of crop rotation have been developed, which enable the paddocks to be cropped, stocked, and fallowed in regular sequence, and sheep have come to be regarded as indispensable for a wheat farm.

(5) The farmer has learned to choose varieties suitable to the climatic and soil conditions of the district, and to adjust the time of sowing and rate of seeding to the needs of the soil.

I think it may be safely said that, with respect to the wheat culture, sufficient knowledge of the fundamentals for success have been gained to enable the wheat average of the State to be lifted to at least 18 bushels per acre during the next 20 years.

Yields of Farm Crops other than Wheat.

With respect to other farm crops, there has not been the same concentration of effort toward the production of new and improved varieties as there has been with wheat, nor have the requirements of the crops been worked out in such detail.

Whilst all the varieties of wheat in general cultivation to-day have been developed by Australian breeders, very few of the other farm crops have been developed locally.

The greater part of the oats sown in Australia is Algerian, an exceedingly useful but very mixed variety.

The greater part of the feed barley grown is Cape, and an average field of Cape barley presents a heterogeneous mixture of types.

We have no distinct varieties of flax. All the seed sown in Victoria is just flax, and is the progeny of imported Russian seed.

There is much need for systematic work on these crops (1) to produce varieties suited to the needs of the varying soils and districts of the State, and (2) to determine the factors which make for consistently heavy yields.

What can be done in this way can be shown by a simple illustration. Flax has been cultivated for the past 20 years in Victoria, but all the flax grown has been derived from imported Russian seed. A casual inspection of any flax field at harvest time will reveal a

Types of Flax. Selections at Werribee.

Fig. 1—Drouin Flax. Fig. 2—Short strawed Commercial Seed Flax. Fig. 3—Werribee Seed Selection. Fig. 4—Werribee Fibre Selection.

number of distinct types of flax, some of great length and quality, which make excellent fibre varieties, and others of small stature, branching habits, and well-developed seed pods, highly suited for linseed production.

A number of distinct strains have been isolated and developed at Werribee during the past four years, one of which, a fibre selection, grows, under favorable conditions, from 4 feet to 4 ft. 6 in. high, and another, a seed selection, with a normal height of 18 inches, densely covered with seed pods. Both these types promise to be of great value to the flax and linseed industry of the State.

The Value of Selection as a Means of Increasing the Yield of Farm Crops.

Now let us consider how farm crops can be improved by selection. The possibility of improving plants or animals rests on two things—

(1) Variation.

(2) The capacity of the plant or animal to transmit the variation to its offspring.

If every individual plant of a given variety were alike, no improvement would be possible. If variations occurred and were not transmitted from parent to offspring, improvement would not be possible. So we see that improvement comes about only when variations which are capable of being transmitted appear among plants or animals.

Now we cannot enter here on a discussion of the nature of variation, or why variations occur. It is sufficient for our purpose to remember that variations do occur, and some of them are inherited. On this simple fact lies the foundation of all improvement either in animals or plants.

Some of the variations may be of a minor character, *e.g.*, a slight difference in the shape of the ear of wheat, the height of the plant, the appearance of a slight beard on an otherwise beardless variety. These minor variations may be caused by differences in soil and in the nutriment the plant receives, and are of little consequence in the improvement of the type. Such variations are not transmitted to the offspring.

On the other hand, you may find a plant differing very substantially from its fellows. It may develop a different coloured chaff, acquire a full beard, develop disease-resistance to a high degree, or possess unusual yielding capacity.

Such large variations are called *sports,* or *mutations.* Generally they are caused by changes in structure of the germ cells or reproductive matter of the plant. These sports, therefore, generally breed true to type. They form the starting point of new varieties, and many of the varieties grown to-day are selections made from plants showing wide variations from the crops from which they were taken. The nectarine is a sport from the peach, the Centennial grape a sport from the Waltham Cross.

Occasionally one or two plants in a crop of wheat show striking differences from the rest of the plants—their superior qualities immediately attract attention—they are like Shakespeares among men. If these outstanding plants are isolated and seed raised from them, valuable varieties may result.

Dart's Imperial was so developed. Mr. Dart, of Nhill, was stripping wheat at Lucerndale nearly 40 years ago, when his attention was arrested by a plant of unusual merit. He jumped off his stripper, seized the plant, saved the seed, and from it came the popular variety "Dart's Imperial," which has retained its prolific qualities for over a generation. Gluyas, Steinwedel, King's Early, Petatz Surprise, Carmichael's Eclipse, &c., had a similar origin.

Federation and Yandilla King. Two of the most popular and prolific varieties of cross-bred wheat in general cultivation.

These sports or mutations are frequently present in a crop. Many are of little value, but occasionally plants of unusual excellence are met with.

This gives the wheat-grower an excellent opportunity of securing a prolific strain of the variety. Nature produces these sports sparingly. Man seizes them and makes them the starting point for new types.

This method of selecting outstanding plants of unusual merit and using them for the production of a new variety is within the reach of every farmer. During the past few years two new varieties of promise—Dollar and Huff's Imperial—have been produced by enterprising wheat-growers.

With crops such as Algerian oats, Cape barley, and flax, there is practically a new and unexplored field, both for the farmer and the specialist breeder, because these crops have not been subject to systematic search for new types.

Selection of individual plants is the best way to develop new strains and varieties true to type.

To improve the yielding power of a crop, growers often practise the selection of a large number of good plants instead of relying on one individual plant. This method of selection is called mass selection, and has been practised with great success in Europe and America.

The following table shows how oats, barley, and potatoes have responded to mass selection at the Ontario Agricultural College, Canada:—

Crop.	1890–93. Bushels.	1894–97. Bushels.	1898–1901. Bushels.	1902–05. Bushels.
Oats	74	79	83	100
Barley	50	54	63	63
Potatoes	120	216	218	249

It will be seen that the average yield of oats was increased over sixteen years by 26 bushels per acre, barley by 13 bushels, whilst the potato crop was more than doubled.

The object of mass selection is to select a large number of the best individual plants from a crop and propagate them in a stud plot, and continue the selection of the best plants year after year. This was the method adopted by the Horsham Agricultural Society in its seed selection competition for a period of three years. In this competition the competitors had three plots—

(1) A "stud" plot of one-fifth of an acre grown from seed selected for three years in succession from the best ears in the crop.

(2) A "seed" plot of 2 acres on which the produce of the previous year's stud plot was grown.

(3) A bulk plot of 25 acres, on which the produce of the previous year's seed plot was grown.

The winner of the competition grew a crop of 38 bushels per acre during 1919, with a rainfall of 4½ inches during the growing period.

This method of mass selection is especially useful for farmers to improve yields of wheat, oats, and barley. The amount of improvement that may be expected is from 10 to 20 per cent., according to the skill shown in selection. The improvement is most rapid during the first few years of selection.

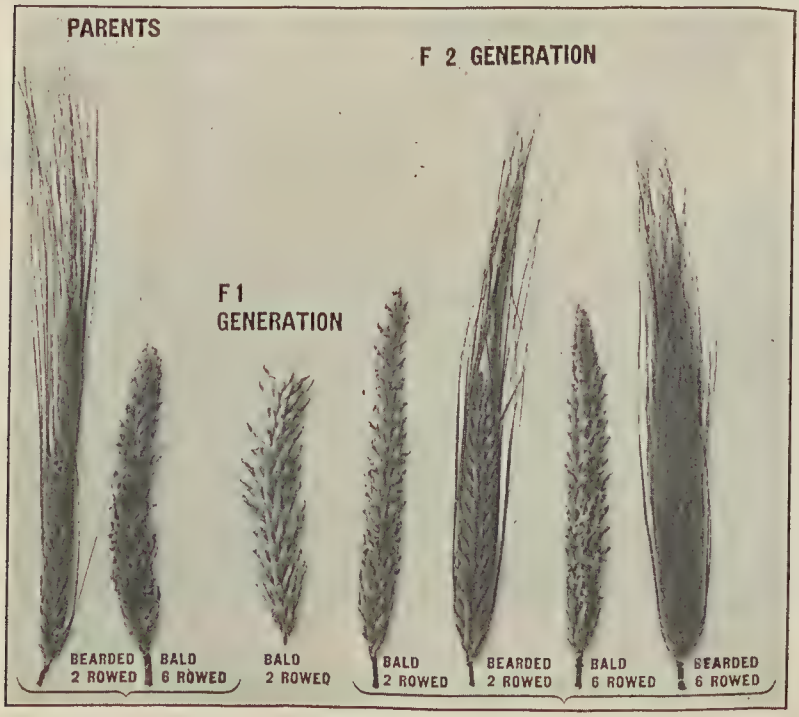
Both these methods of selection will counteract any tendency of the cereal to degenerate. Old varieties may be kept up to a high standard of yield.

Grading the seed and the reservation of the cleanest portions of the farm for the production of seed should supplement selection.

Numerous experiments have confirmed the value of grading seed, and the elimination by the grader of all shrivelled, pinched, and cracked grain from the seed. Increases in yield of from 8 to 10 per cent. may be relied on when seed is properly graded.

Potatoes, maize, and sugar beet are particularly responsive to selection. In fact, selection will generally show more substantial increases in yield with these crops than with wheat, oats, or barley.

To maintain the yield in a good potato district the seed should be selected in the field, so that the standard of trueness to type and



Cross-bred Barleys.

Photograph showing segregation of types of barley in a cross between malting barley (bearded two-rowed) and skinless barley (bald six-rowed).

All plants in the first generation are alike (bald two-rowed). In the second generation four types segregate out—bald two-rowed, bearded two-rowed, bald six-rowed, bearded six-rowed. All these types may be fixed and developed into new strains of barley.

yielding capacity may be maintained unimpaired. The seed should be selected from the most desirable plants, those which are healthiest, most vigorous, and producing the greatest number of marketable size tubers, and this selection can only be done in the field. In Europe it has long been held that seed potatoes harvested green, *i.e.*, immature seed, have greater vigour and productiveness than mature seed. Consequently, in the best potato districts of Europe it is a regular practice to dig the seed before the plants have ripened. The general practice in raising ordinary farm crops is to allow the seed to thoroughly

mature. The potato, however, is not really seed, but a part of the stem of the parent plant, and experience has clearly demonstrated that immature seed dug before the plant has ripened is superior in yielding capacity to mature seed. Immature seed tested alongside mature seed in departmental experimental plots over five years has averaged 25 to 30 per cent. better returns than mature seed.

Some growers maintain that if potatoes are grown year after year on the same soil and farm they degenerate. Experience has demonstrated, however, that by selecting immature seed from vigorous plants in the field the yielding quality of a variety can be indefinitely maintained. At the Ballarat Orphanage strains of potatoes have been kept true to type and prolific for over thirty years by this method.

In their endeavour to keep the island of Jersey free from potato diseases, the local authorities have made it a penal offence to introduce any new varieties of potato. The growers are, therefore, debarred from obtaining fresh seed from outside sources. The Royal Jersey kidney potato has been grown for over fifty years, and its prolificacy has been maintained unimpaired by selection.

Maize lends itself admirably to improvement by selection because the ears are so large and the kernels of the same ear have the same qualities, provided cross pollination with neighbouring variety is eliminated. The basis of maize selection lies in the relative constancy of the grains of the individual ear. The objective is to increase the yielding capacity of the crop; and success depends on selecting ears which are capable of producing heavier yields than the average of the crop. You cannot always tell by mere inspection which plants will produce high-yielding progeny any more than you can pick out a Cup winner from a group of yearlings, or a 1,000-gallon cow from a group of heifers. But pedigree, breeding, conformation, and appearance will go far in assisting the grower in isolating plants of undoubted merit. The ultimate test of the value of any selection must be performance—the actual yield which each selection gives on trial in the field.

The fields should be carefully gone through at harvest time and the best-developed plants examined. The ears are selected on their size, weight, shape, straightness of rows, perfection of butt and tip, and uniformity of kernel.

This is the preparatory work of selection. The real selection is effected on the ear-to-row breeding plot, since the aim is to isolate the prolific types and to select ultimately on performance, not appearance. Each ear is given a separate row of uniform length, say 5 chains, and about one-half of the seed is sown in each row. The individuality of each row is usually quite conspicuous. A whole row grown from the kernels of a single ear may produce numerous barren stalks, or weak plants, or they may be uniformly excellent in vigour and yield—but the plants from one ear are remarkably uniform. The yield of each row is determined at harvest time, and the best ten rows are selected to provide ears for the breeding plot. In this breeding plot we have all the strains of proved high-yielding capacity as determined by actual performance in the field. The best ears from the breeding plot are used to continue the selection, while the remainder of the seed is sown on a "seed" plot. The produce of the seed plot will give sufficient

seed to sow the whole farm with selected maize. The essential features of the method are—

(1) The initial choice of the best ears.

(2) The comparative trial of each ear in an ear-to-row breeding plot to determine the prolific yielders by actual performance.

(3) Repeated selection of each year from the best ten rows.

This is the method followed by the Illinois Cornbreeders' Association and by a number of private seed firms in America, notably, Funk Bros., the originators of Funks' Yellow Dent, who have developed maize breeding to a vast and profitable business enterprise.

Maize breeding has been carried out on these lines in New South Wales for the past five years, and the results have clearly shown that maize-growers may increase their yields by at least from 15 to 20 per cent. by this method.

View of Wheat Selection Plots, Rutherglen Experiment Farm, showing plots set apart for mass selection of best ears of wheat.

Sugar beet affords an interesting example of the value of selection. During the past century the sugar content of beets has been gradually raised from 7 to 20 per cent. This increase has been won with great difficulty, and most of the increase has been made during the past 25 years, when exact scientific methods have been applied to selection. Without the application of continuous systematic selection, the sugar content of beets would soon fall, and the cultivation become unprofitable. The improvement can only be profitably undertaken by large corporations, because of the immense cost and the large amount of technical knowledge necessary for the enterprise.

Limitations of Selection.

We have seen that there is ample scope for improving our farm crops by selection, both in yield per acre, *e.g.*, cereals, and in quality, *e.g.*, sugar beet.

The farmer can materially assist in this work. He should grow his seed on well-prepared clean land, endeavour to secure it true to type and free from strange plants, and grade it, with a view to eliminating the weak plants produced from undersized grains.

He may, like Dart, Gluyas, King, Steinwedel, and others, benefit his fellowmen by seizing on unusual variations and making them the starting point for new strains or varieties. Every paddock of wheat, oats, barley, and flax contains a few plants of extraordinary value could we but detect them. Or, finally, he may, if a cereal-grower, deliberately attempt to increase the prolificacy of his crop by the various methods of selection outlined above.

But the following truth needs to be carefully observed:—*Selection cannot create anything new;* it can merely take advantage of a varia-

View of Wheat Breeding Plots, Longerenong Agricultural College.

tion which nature has given us, and preserve it. Nature continually causes variations to appear in plants. Some of these variations are due to varying environment. These are not inherited. Other variations, the mutations or sports, are more rarely produced, and breed true to type. These variations are the basis of selection and the source of all progress. The function of selection is merely to detect these hereditary variations, and, through them, isolate a race with the desired characters.

Cross-breeding, on the other hand, enables one to continue in one plant the desirable qualities of several plants. It is absolutely the most potent weapon in the armoury of the plant breeder for the production of new forms. If any given plant is lacking in a desired

quality, no amount of selection can improve that plant in respect to that quality. But with cross-breeding the qualities of the parents are recombined in various forms in their offspring, so that the desirable qualities of several varieties may be obtained in one variety.

Many of the prolific wheats grown in the wheat belt are cross-breds, *e.g.*, Federation, Yandilla King, Currawa, Major, Warden, Bobs, Comeback, Bunyip. The production of new cross-bred varieties is not difficult, but the fixing and testing of the new crossbred involves technical difficulties, so that this work will be done largely by wheat specialists. The discoveries of Mendel have served to place cross-breeding on a perfectly scientific basis, and the well-informed plant breeder may enter upon his task of improvement without leaving much to chance.

Summary.

Plant improvement is the latest and most promising development in modern agriculture. Improved varieties have materially increased the yield of farm crops in the old world, and have done much to increase wheat yields in Victoria.

Selection is a powerful means for developing the prolificacy of farm crops and in producing new and improved varieties. It can be applied with every prospect of success to wheat, barley, oats, flax, and especially to potatoes and maize. Individual selection, *i.e.*, isolation of prolific sports, can be used as a starting point for new and improved varieties. Mass selection, *i.e.*, continuous selection of a number of *élite* plants, can be profitably used with wheat, oats, barley, but particularly in the case of maize and potatoes. To achieve best results selection should be supplemented by choice of varieties suited to the soil and climatic conditions, the grading of the seed, and the reservation of the cleanest portion of the farm for seed production.

Selection has its limitations so far as the production of new varieties is concerned. Selection does not of itself create anything new. It merely preserves the variations which nature produces. Cross-breeding combines in one plant the merits of several types. It offers most promise as a means of producing new cereals, and the recent discoveries have given the breeder a scientific basis for his work.

There is an unlimited field in Australia for the application of the same systematic methods for the improvement of oat, barley, maize, and potato varieties.

The efforts of State Departments of Agriculture and plant breeders have hitherto been concentrated on wheat—our most important staple crop—and the results have been highly satisfactory. There is an unlimited field for the application of systematic methods of breeding for the production of improved varieties of oats, barley, potatoes, maize, and flax, and there can be no doubt that a systematic offensive for the improvement of these crops will ultimately be crowned with success. It would be wise policy on the part of the State to encourage trained men to specialize on these crops, with a view of producing strains as superior to existing types as the present-day wheat varieties are to those cultivated thirty years ago.

GOVERNMENT HERD TEST.

SUMMARY OF RESULTS FOR THE YEAR ENDING JUNE, 1920.

The following tables are published as officially setting out in a form which facilitates comparison, results which should be of considerable value to those interested in the breeding of dairy stock:—

TABLE I.

SHOWING the Number of Cows of different Breeds tested, and the Number and Percentage of each Breed which obtained Certificates under Government Herd Test regulations (273 days' test) during 1919–20, together with the total yields and average per cow of milk and butter fat for each breed.

Breed.	No. of Herds in Test.	Average Cows per Herd.	No. of Cows in Test.	Number Certificated.	Percentage Certificated.	Total Milk.	Total Butter Fat.	Average per Cow.	
								Milk.	Butter Fat.
					%	lbs.	lbs.	lbs.	lbs.
Friesian..	5	11·2	56	55	98·2	531,020	19,890·71	9,655	361·65
Jersey ..	36	8·3	299	272	91·0	1,665,766	90,750·70	6,124	333·64
Red Poll	3	16·6	50	37	74·0	284,392	12,329·96	7,686	333·24
Shorthorn	6	5·5	33	25	75·7	189,081	7,645·45	7,563	305·81
Ayrshire	26	10·1	262	181	69·1	1,244,147	53,945·72	6,874	298·04
Total..	76	10·34	700	570	81·6	3,914,406	184,562·54	7,580	326·47

(The last four columns refer to yields of certificated cows only.)

TABLE II.

SHOWING the Percentages of Mature Cows, Second-calf Cows, and First-calf Cows respectively of the different Breeds which obtained Certificates during 1919–20.

Breed.	Percentage of Mature Cows.	Percentage of Second-calf Cows.	Percentage of Heifers.
Friesian	49·1	16·4	34·5
Jersey	45·9	25·0	29·0
Red Poll	81·1	5·4	13·5
Shorthorn	44·0	28·0	28·0
Ayrshire	53·6	25·4	21·0

SUMMER FORAGE CROPS.

(*George S. Gordon, Science Field Officer, State Research Farm, Werribee.*)

The growth and conservation of forage crops is the best form of insurance against seasons of scarcity for the stock-owner, whether his area of land be large or small. Both squatter and settler should provide for the future, not only on account of the advisability of preparing for a possible bad season, but also because it will "pay" in good years. An ample supply of suitable feed during the comparatively lean months of winter and summer enables more stock to be carried in good condition, more lambs may be fattened for an early market, and more milk produced. The additional stock carried will help to utilize the abundant

1. Five weeks' growth on Lucerne eight years old. Fourth "cut" for Season, 23rd February, 1921.

and sometimes surplus growth of spring to better advantage. On the other hand, an attempt to stock the farm up to its spring carrying capacity, without making adequate provision for feed during the rest of the year, is a form of overstocking—implying underfeeding—which is preventable, and, therefore, closely related to cruelty. Both summer and winter forage crops are grown at the State Research Farm, and the following particulars regarding the results of the former will, no doubt, be of interest.

The most successful forage crop at Werribee is undoubtedly lucerne. It not only gives from four to six "cuts" during the warm months, but also provides splendid grazing in winter. With irrigation and proper

treatment, it has given such good results year after year that the necessity of annually sowing large areas of other summer crops has, to a large extent, been obviated.

Illustration No. 1 will help to convey some idea of the value of lucerne as a summer forage crop, either for use in the green state or conservation in the form of hay. This picture was taken on 23rd February, 1921, and shows the fourth "cut" for the past season on lucerne which is eight years old. The crop represents about five weeks' growth which would yield quite 30 cwt. of hay per acre.

Lucerne has thus justified its reputation as "king of forage crops" at Werribee. It is recognised, however, that annual crops such as maize, sorghum, millet, &c., may suit the conditions prevailing in other districts better, and small areas of these have been grown in order to test their yield and utility. In the past season they were grown under irrigation in rows spaced 3 feet apart, and were sown on 15th October, 1920. On 23rd February, 1921, representative samples were cut and weighed. The yields of green forage at this date, together with notes on the second growth, are given in Table No. I. below, and sample bundles, containing the produce from an area of 10 square yards of each variety are depicted in Illustration No. 2.

TABLE No. I.

SUMMER FORAGE CROPS—SEASON 1920-21.

Seed sown in drills 3 feet apart, 15th October, 1920. Samples cut and weighed 23rd February, 1921.

Variety.	Yield Per Acre. Tons	Cwt.	Remarks on Second Growth, June 28, 1921.
Orange Cane	13	12	This gave a good second growth.
Imphee	12	10	Gave the best second growth, still green
Sacaline	12	0	Gave a fair second growth, still green
Japanese Millet	12	0	Fair second growth, now dead
Early Amber Cane ..	9	0	Fair second growth
Sorghum Saccharatum ..	8	4	Fair second growth
Sudan Grass	5	8	Gave a good second growth up to 2 ft. high
Hungarian Millet ..	2	2	Practically no second growth
Egyptian or Pearl Millet ..	—	—	Failed
Teosinte	—	—	Failed

2.—Summer Forages, Season 1920-21.

Varieties Shown in Illustration.	Orange Cane.	Imphee.	Sacaline.	Sorghum Saccharatum.	Early Amber Cane.	Japanese Millet.	Sudan Grass.	Hungarian Millet.
Weight of Green Forage per acre	tons cwt. 13 12	tons cwt. 12 10	tons cwt. 12 0	tons cwt. 8 4	tons cwt. 9 0	tons cwt. 12 0	tons cwt. 5 8	tons cwt. 2 2

NOTE.—Each bundle is the produce of ten square yards cut on 23rd February, 1921.

Six of the varieties mentioned in table No. I. have been grown for three years, and the average yield of each for this period is recorded in Table No. II. below:—

TABLE No. II.

Average Yield of Summer Forages for Three Years.

Variety.	Yield Per Acre.	
	Tons	Cwt.
Imphee	13	10
Orange Cane	12	9
Early Amber Cane	9	13
Japanese Millet	8	13
Sorghum Saccharatum	7	18
Sudan Grass	4	16

Maize was also grown each year, but was left for grain, and no records of its yield for green forage are available. It is, however, a very fine summer forage crop, Hickory King and Eclipse being probably the most suitable varieties for this purpose.

All the varieties mentioned in Table No. II. may be considered good forage crops, and the varying yield suggests that the choice of one suitable to a particular district and farm requirements is an important factor in successful dairy and stock farming. The following brief notes on the varieties may be useful:—

Imphee, or Planter's Friend, is a heavy yielder, has a softer and more succulent stem than sorghum or amber cane. It not only withstands dry conditions, but resists early frosts fairly well. It will, therefore, carry into the winter better than other summer forages of this class.

Orange Cane is a comparatively new variety which has given good results in America. It resembles sorghum and amber cane, but is later in maturing, and during the past three years has consistently given a greater yield than the two varieties just mentioned.

Early Amber Cane and Sorghum Saccharatum.—These are fairly well-known forages, which stand heat well, and will grow under drier conditions than maize, though, as with most summer crops, an ample supply of moisture is necessary to obtain maximum results. All varieties of sorghum contain a volatile poison during their early growth, and to avoid danger of poisoning they should either be cut and left to wilt for a day, or remain till they flower, before being fed to stock.

Japanese Millet is probably the best of the millets for forage purposes. It is a good milk producer, and, unlike any of the above varieties, can be fed to or grazed by stock at any period of its growth without danger of poisoning. Probably the best results are obtained by feeding it off while fairly young, and then spelling the crop till the next growth is ready.

Sudan Grass.—This resembles a miniature sorghum, and, having fine stalks, it can be made into hay. It makes successive growths under suitable conditions, and has generally been an attractive plot, through its yield per acre has been low at Werribee.

Now is the time to plough and prepare the ground for summer forage crops to be sown next spring.

MANGELS AND MAIZE FOR SUMMER FODDER.

GET READY NOW.

By J. S. McFadzean, Senior Dairy Supervizor.

The milk yield of the dairy herd right up to next July will depend largely on the preparations for cropping made during the next two months of August and September. Mangels or sugar beet, and in late districts Tartarian oats, should be sown in these months; and the earlier the better. In every district preparations for the coming maize crop should also be well in hand. It will pay to work always as though each coming spring was certain to be a short growing season, and to have all ploughing and sowing done as soon as possible. Should a poor germination of any crop then occur, there is always the chance of being able to make another sowing, which will not happen if the main sowing is left late.

Mangels do well almost anywhere if sown early, but, of course, the better the land is, the heavier the crop will be. The globe mangel is the best variety for a shallow soil. Four to five pounds of seed will sow an acre, a hand-drill usually saving a pound of seed over hand sowing. A fair average return will be from 25 to 30 tons of roots per acre. The rows should be about 30 inches apart, and the plants may be thinned out to about 8 inches apart. If well rotted manure is available for ploughing in, the crop may be largely increased thereby, but if the manure is not rotted it will be as well to use a mixed fertilizer, and plough the manure into the maize land. Mangel seed is slow of germination, and, therefore, it is as well to soak it in water for two or three days prior to sowing. If a drill be used, the seed should be drained for a few hours before sowing; or if mixed with some fine sand or ashes the water will be taken up sufficiently to allow of the seed running through freely. Care should be taken not to let the seed become in any way dry again after soaking and draining, and if not all drilled in or sown quickly, it should be kept between damp bags to prevent drying.

In many places where mangel cultivation is followed out regularly it is the practice to ridge the land up with a double mould-board plough, and sow on top of the ridge by hand drill. This method greatly facilitates the cleaning up of the weeds at a later stage; and, with the hoeing, the land levels back again as it falls away from the upper portion of the growing roots. By the soaking of the seed not only is a quick and even germination obtained, but the young plants get a good start of the weeds; and the first hoeing of the crop can be done much earlier than otherwise would be possible.

As the plants grow, the lower leaves may be used for feeding any stock, and in time of scarcity the crop can be used at any stage of growth. If the roots are not wanted immediately the crop is matured, they may be lifted and stacked in a heap on any well-drained spot, and covered with straw litter and soil over that, to keep the roots from shrivelling up under dry winds or heat, they will keep for months. Mangels or sugar beet are good feed for cattle, sheep, pigs, and poultry, and some area should be sown with this crop on every farm each year.

Half-an-acre of land per dairy cow should be cultivated each year for green fodder wherever dairying is carried on. If properly manured and worked, this will give at least 3 tons of green oats or barley, and 10 tons of green maize under a very ordinary season; and very frequently this yield will be greatly exceeded. This thirteen tons of green fodder will keep a big cow well fed all through the rest of the year when the spring grass is finshed. All surplus green-stuff in the spring should be made to silage, unless required for hay for horse feed. Oaten or barley silage from the spring cutting will keep the herd milking well until the first sowing of maize is ready to cut, and the maize crop will carry the cattle on until the autumn-sown green-stuff is ready.

The area of land reserved for maize sowing should be ploughed as early as possible in the winter, and worked up well when the opportunity offers. An extra working of maize land may easily mean from 5 to 10 tons more fodder per acre; so it is worth putting the disc over it to break up any clods. The land to be sown may be divided into four sections, the first being sown towards the end of September or early in October, according to how the weather has warmed up. With the land ready the farmer is able to get this first sowing in quickly if a few warm days come along early. The next two sections can be sown about three weeks later, or even the whole can be sown at this stage if there are indications of a dry season. Otherwise the fourth section may be reserved for a sowing about the beginning of November.

Unless the land is quite damp at date of sowing it will pay to soak the maize seed in water for a day or two, and with a few warm days an even crop will show up within a week. Without soaking of the seed a very uneven crop may result if the land is all cloddy or dry. Seed soaked for twenty-four hours and left to drain under bags for another twelve hours will run freely through the drill; and soaked seed does not crack at all. Where the land has not been dressed with farmyard manure some superphosphate should be used, and from 1 to 2 cwt. per acre will give good results. Maize should be sown in drills not less than 3 feet wide, and if the surface of the soil between the rows is kept loose the maize crop will stand a very severe spell of heat without damage. In working between the rows only the surface soil should be stirred, or the roots may be broken. This crop throws out surface roots in every direction, and if the cultivator is inclined to run deep into the soil some brush should be fixed below it to keep it working only on the surface.

Should any sowing not come on well it should be followed up quickly with another, even if this is late in the year, for it is always better to have a few tons more of surplus fodder than to let the cows run short. If the milk flow is checked by want of feed in either summer or autumn there is little chance of the yield being brought back again that season.

If there is no silo on the farm to conserve the surplus fodder, this can be made into stack silage. Directions for all this silage-making work can be had on application to the Department of Agriculture. Silos are also built on extended terms of payment, if application is made early in the year. In fact, this cannot be done too soon. Frequently the services of an officer are available to give instruction in silage making. Every facility is thus offered to dairy farmers to become expert in fodder growing and feeding; and on the area cultivated for green fodder will largely depend the profits from the dairy herd.

SEED-BORNE DISEASES.

"Take All," *Ophiobolus graminis*, Sacc.: "Flag Smut," *Urocystis tritici*, Koern.

(*C. C. Brittlebank, Vegetable Pathologist.*)

Probably there is no better instance known of certain destructive cereal diseases being carried on the seed than that of the introduction of "Take All" and "Flag Smut" into portions of the wheat area of the United States of America.

During 1918 Australia shipped to America consignments of wheat, amounting in all to 5,500,000 bushels.

The American plant pathologists, being aware of the presence in the Australian wheat crops of the above-named diseases, warned the controlling powers of the danger attending the importation of Australian wheat. The United States Government, in order to guard as far as possible against the entry of disease, prohibited the use of Australian wheat for seed purposes, and restricted its use to gristing purposes only. The flour was shipped to Europe. Notwithstanding these precautions, both "Flag Smut" and "Take All" appeared in their wheat crops during the season following upon the wheat importation. The two diseases being found in the same fields is strong evidence that the Australian wheat was responsible. Considerable areas in several States are now known to be infected. The introduction of these diseases into America, in spite of the precautions taken, show the danger that is run in importing seed from oversea countries where serious diseases are known to exist.

In the case of "Flag Smut" and "Take All," probably infection is due to the spores of the fungi being retained in the offal, which, if fed to farm animals, would, at least in some cases, infect wheat lands.

At the first onset of the "Take All" disease in the United States, there appeared to be some doubt as to whether it was *Ophiobolus graminis*, Sacc. However, examination of material from there, I think, leaves no doubt as to the fungus being that which causes the "Take All" disease in the Australian wheat crops. Infections have been made from American material, and the fungus in the perfect stage recovered. As to the length of time these spores retain their vitality, I have no record.

Nor in the case of *Urocystis tritici*, Koern, can it be stated how long the spores will retain vitality; from experiments carried out by the Science Branch of this Department, it is known that it is a period of at least eight years. In the tests referred to spore balls, taken from material which had been in the Herbarium for eight years, were used. All precautions were adopted to guard against outside infection. Wheat grains were pickled, washed, infected, and planted in sterile soil. Several plants were affected, and these are now in the Herbarium.

The serious aspect is that both diseases are very difficult to control, and, I think, impossible to eradicate. Here certain methods for their control have been used with more or less success. Let us hope, knowing only too well the loss caused by these diseases, that the American farmers, working under the guidance of the cereal pathologists, will succeed in eliminating them from their farms.

EXPERIMENTAL WORK AT RESEARCH FARM, JUNE, 1921.

Extract from Report by George S. Gordon, Science Field Officer.

Seeding Conditions.

The summer rains to some extent "set" the fallows, and by the time harvesting operations were completed they were in some cases very hard, and a really satisfactory seed bed was not obtained till fairly late in the autumn. This, with the late arrival of the autumn rains, tended to a rather later start being made with seeding than usual, and without much opportunity being afforded for weed seeds to sprout before the early crops were sown.

Crops Sown.

The usual crops have been sown on the various plots in the "permanent" experimental areas known as the "Rotation," "Fertilizer," and "Green Manurial Rotation" fields; but this year the wheat plots in the two latter sections have been divided, and one-half of each has been sown with Algerian oats. Yields from two cereals will, therefore, be obtained, and further observations regarding the result of the treatment each plot receives will be possible.

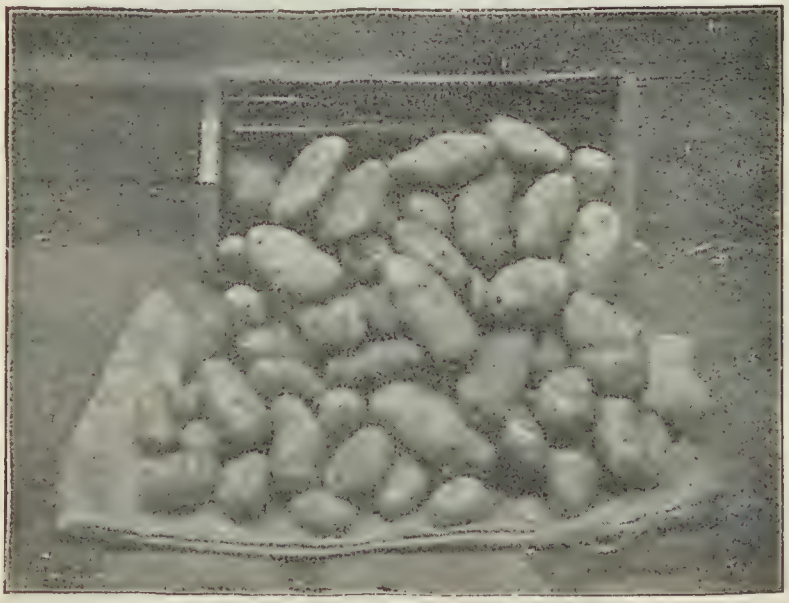
In addition to the bulk wheat plots for the production of pure seed for distribution, the following sections have been sown:—

1. *Seed Plots* (2 acres) comprising—
   - (*a*) Wheat, 10 varieties and new cross-breds.
   - (*b*) Oats, 4 varieties.
   - (*c*) Barley, 3 varieties.
2. *Variety Wheat Plots* ($\frac{1}{2}$ acre), comprising 26 varieties and new cross-breds.
3. *Selection Wheat Plots* ($\frac{1}{20}$ acre), comprising 77 varieties and new cross-breds.
4. *Long Row Plots* (single rows, 5 chains long)—
   - (*a*) Wheat, 322 varieties and new cross-breds.
   - (*b*) Oats, 16 varieties and new cross-breds.
   - (*c*) Barley, 22 varieties and new cross-breds.
5. *Stud Cereal Plots*, comprising—
   - (*a*) Standard varieties of wheat, barley, oats, and rye.
   - (*b*) Cross-breds from same (1st to 6th generation).
   - (*c*) Selections (single plants of various cereals).
   - (*d*) Introduced varieties, &c.

   } Total—over 2,000 plots.
6. *Oat Variety Tests*, 9 plots.
7. *Barley Variety Tests*, 10 plots.
8. *Flax Variety Tests*, 15 plots.
9. *Flax Selections*, 23 plots.
10. *Grass and Clover Varieties*, 60 plots.
11. *Graded Seed Tests, Wheat*, 8 plots.
12. *Early and Late Variety Seeding Tests, Wheat*, 12 plots.
13. *Early and Late Rate of Seeding Tests, Wheat*, 12 plots.
14. *Early and Late Rate of Seeding Tests, Oats*, 6 plots.
15. *Pickling and Bunt Tests*, 14 plots and 45 rows.
16. *Electroculture Tests*, 6 plots.
17. *Physiological Fertilizer Tests*, 8 plots.

A Remarkable New Potato

"EARLIEST OF ALL"



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